No. 2633 VOLUME 76 FRIDAY 28 AUGUST 1959

FLIGHT

AIRCRAFT, SPACECRAFT, MISSILES

Official Organ of the Royal Aero Club First Aeronautical Weekly in the World Founded 1909

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Iliffe & Sons Ltd., Dorset House, Stamford Street, London, S.E.1; telephone Waterloo 3333. Telegrams Flightpres Sedist London. Annual subscriptions: Home £4 15s, Overseas £5. Canada and U.S.A. $15.00. Second Class Mail privileges authorized at New York, N.Y.

Branch Offices Coventry: 8-10 Corporation Street; telephone Coventry 25210. Birmingham: King Edward House, New Street, 2; telephone Midland 7191. Manchester: 260 Deansgate, 3; telephone Blackfriars 4412 or Deansgate 3595. Glasgow: 26B Renfield Street, C.2; telephone Central 1265. New York, N.Y.: Thomas Skinner & Co. (Publishers) Ltd., 111 Broadway, 6; telephone Digby 9-1197.

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He Woke Up England

CLAUDE GRAHAME-WHITE has gone. To most of the industry's young men he was a name. To their elders he was an heroic figure, somewhere betwixt the Wright brothers and Buffalo Bill. For it was this gusty airman showman who stirred their schoolboy blood with a joystick. "Wake up England" was his cry. Fun, fame and fortune were his goals; homage by his peers his destiny. The pre-1914 Hendon days of "G-W" and his band have long been mellow memories. But wherever people gather in this island to enjoy the spectacle of flying and take comfort from the benefits it brings our nation and our race (as at Farnborough next month), the shade of Grahame-White will look benignly on.

Reverting to Autorotation

AT LAST, it seems, the autogyro is returning to claim its birthright. Why this should ever have been in jeopardy is one of those minor mysteries of aeronautics. Certainly the type of aircraft sustained by a free-turning rotor has never been considered prodigal in terms of money; nor has it proved a black sheep in any technical sense. The fact is that it has been cheated and neglected.

We are thinking not of Fairey's mighty Rotodyne (which, after all, is just a grown-up and very sophisticated member of the same family); nor of the Bensen Gyro-Copter, that ingenious and ingenuous tiny tot that looks like giving a lot of people a lot of fun. We have in mind, rather, the touring type of autogyro—the back-yard family runabout so dear to the public imagination in the years before the war, and precisely the class of vehicle that someone in our own contracting industry should now be scrutinizing very carefully. It was to this country, after all, that Juan de la Cierva turned for the sympathetic development of his original autogyro ideas; and here, too, new adaptations and applications came to pass.

But we have learnt better sense, in this industry, than to look to history for our comfort or to mouth pious sentiments for our consolation. The earnest reappraisal of the autogyro that is now advocated must stem from hard business considerations. We are witnessing the little Bensen gradually catching on with the sportsman. We have seen, too, that gallant Italian airman, the late Mario de Bernardi, turning his thoughts to the combination of a freely rotating rotor with a conventional aeroplane; and more lately, at the Paris Show, there has appeared the Helicop-Air Girhel—an entrant in the French Government's competition for an *aéronef de grande vulgarisation*. (That fascinating description alone conveys that this autogyro is intended to compete with the aeroplane more or less on its own terms.)

In Canada, with a nucleus of ex-Avro engineers, Avian Industries Ltd., are busily at work on the Avian 2/180 illustrated on page 79 of this issue. From America we hear that Fairchild have secured manufacturing rights for the Umbaugh 18, and that Kellett—the original holders of the Cierva licence in the U.S.A.—are staging a come-back with a scarcely altered version of one of their pre-war models. (So much for "progress along every frontier of aeronautical endeavour," etc., etc.)

If the simple, safe and immensely appealing autogyro form of aircraft is at last to come into its own, as the helicopter has done (and there is much to suggest that it will); and if Great Britain is not to be numbered among its most ardent sponsors, then a new chink will be opened to admit public censure of our already vulnerable industry.

FROM ALL QUARTERS

Claude Grahame-White

WE record with regret that Claude Grahame-White, the pioneer airman and motorist, died in hospital at Nice on August 19 within two days of his eightieth birthday. He was the first Englishman to be granted a certificate of proficiency as an aviator (in France in 1909); and in 1910 he secured the land which subsequently became Hendon Aerodrome, establishing there the Grahame-White Co. Ltd. and its associated flying school, a great centre for pre-First World War aviators.

Claude Grahame-White's contribution to British aviation was largely confined to the years before 1914-18 and it is as a dashing and skilful pilot, who stimulated others by his example, that he will be remembered. After obtaining his pilot's certificate (under Blériot's tuition) he started a school of flying at Pau, transferring it to England in 1910. In April that year he participated in the *Daily Mail* London - Manchester race, the event which first brought him fame. This race was won by Louis Paulhan, but Grahame-White made two courageous attempts, flying on through the night but having to come down at Lichfield.

In the same year he toured the United States, winning the Gordon-Bennett Race (a great feather in the cap of British aviation), and gaining some £90,000 in prize money. When he returned to this country he did much to popularize flying; in 1911 his company inaugurated an air-mail service; and he also demonstrated—to Cabinet Ministers at Hendon—the military possibilities of aircraft.

During the First World War Grahame-White was commissioned in the R.N.A.S. but resigned to superintend Government contracts for building aircraft. After the war he sold out his interests in aviation and went back into the motor business, selling Hendon Aerodrome in 1925 for £500,000. He wrote several books on aviation (with Harry Harper) and was a founder-member of the Royal Aero Club, holding the club's No. 6 pilot certificate.

First Civilian Controller

A NEW post has been announced for Sir George Gardner, who has been Director of the Royal Aircraft Establishment, Farnborough, since November 1955. He is to be Controller of Aircraft, Ministry of Supply, thus becoming the first scientist other than a serving officer of the R.A.F. to hold this appointment. He succeeds Air Chief Marshal Sir Claude Pelly. Sir George's successor at R.A.E. is to be Prof. M. J. Lighthill, F.R.S., Beyer Professor of Applied Mathematics at Manchester University since 1950.

S.E.5A Flies Again

ONLY former R.F.C. pilots there, like Lord Douglas of Kirtleside and W/C. John Unwin, really knew what to expect; the rest of us [writes H.W.] had only seen an S.E.5A in First World War pictures, chasing Albatros scouts or with white puffs of "archie" bursting around it. Yet here was one of these famous

ON A FAVOURITE FARMAN: An early "Flight" portrait of Claude Grahame-White, whose death is recorded on this page

aeroplanes at Farnborough last Saturday, climbing briskly into Hampshire skies as if "patrolling against the Hun."

This was a peaceful occasion, however, a demonstration of the S.E.5A presented to the Shuttleworth Trust by Armstrong Whitworth Aircraft Ltd. and restored to flying condition by apprentices of the Royal Aircraft Establishment (as a craft exercise), assisted voluntarily by some older R.A.E. members. As Sir George Gardner put it, the S.E.5A is "part of the history of the R.A.E."; and he thanked all those who had assisted in restoring the aircraft —which, though belonging to the Trust, is to be kept at Farnborough.

A. Cdre. Allen Wheeler, the Trust's chairman, said that without Sir George's help the rebuilding project would have been impossible; he called the S.E.5A "a perfect aeroplane," and subsequently both he and Cdr. Ken Hickson (O.C. Flying at Farnborough) gave attractive demonstrations of its graceful capabilities.

Restoration of this machine (D7000) after its long languishment in a hangar at Baginton has taken just over 2¼ years and much industry, research and ingenuity. The engine, a 200 h.p. Hispano-Suiza, came from the Science Museum; the Vickers gun from R.A.F. Henlow; the compass was given by W/C. Unwin. Many new parts have had to be made and all the woodwork replaced. The result is a credit to all concerned. Ball and McCudden would have been delighted to see one of their famous fighting mounts so professionally re-created.

R.Ae.S. Rotorcraft Section

MEMBERS of the Helicopter Association voted overwhelmingly at an extraordinary general meeting on July 10 in favour of merging with the Royal Aeronautical Society and becoming its rotorcraft section. The meeting was then adjourned and is to be re-convened at a suitable date, to vote on another special resolution, that the Association should be wound up.

Mr. Peter Masefield, R.Ae.S. president, stressed at the July 10 meeting that the Society would be proud to give every support to the Association in its new guise as R.Ae.S. Rotorcraft Section, under its own committee and with its own awards and section membership, proceeding autonomously within the Society.

BRITISH FIGHTER DESIGN, typified in two recent pictures. Left, Spitfire and Hurricane (which will make their last Battle of Britain appearance on September 20), Hunter and Javelin; and below, S.E.5A. The S.E. was demonstrated at Farnborough (where it was designed) last week-end, as recorded in a news item above

PLAYING STORK: A Westland Whirlwind performs pre-unveiling publicity rites in respect of the new Morris Mini-Minor, while "Flight's" Gemini comes alongside to take pictures for our associated journal "The Autocar" (in today's issue of which a description and road test of the Mini-Minor appears)

Discussing Aerial Farming

AN International Agricultural Aviation Conference—the first event of its kind in Europe—is being held at the College of Aeronautics, Cranfield, Beds, from September 14 to 18. About 250 delegates are attending (representing countries in Europe, America and Australasia) and on the last day there will be a flying and static display of fixed-wing aircraft and helicopters used for agricultural purposes, with associated equipment.

Sir Miles Thomas, chairman of Monsanto Chemicals and formerly chairman of B.O.A.C., is to review developments in agricultural aviation in an inaugural address; and papers to be given at the conference—which is organized by the Ministry of Agriculture, Fisheries and Food in co-operation with OEEC and its specialist body, the European Agricultural Aviation Centre at The Hague—will touch on all aspects of aerial farming. The flying and static display, in which some 17 aircraft and 16 manufacturers are participating has been arranged by the National Association of Agricultural Contractors.

Scottish Surveyor

ORDERED by Rio Tinto Co. Ltd., a Scottish Aviation Twin Pioneer, G-AOER, has been equipped for geophysical survey duties and will be shown at the Farnborough display next month prior to delivery. Outwardly, it differs in appearance from other Twin Pioneers in that its wing-span is increased by 9ft through the installation of wing-tip pods carrying electro-magnetic equipment. The aircraft's large span enables the transmitting and receiving coils of the equipment to be adequately separated.

When operating in its survey rôle the aircraft will carry, in addition to its electro-magnetic unit, a magnetometer, scintillometer, strip camera and Edin recorder. It also has a large camera hatch which can accommodate such cameras as the Wild RL5 or RL7. Four surveyors can be carried in addition to the two pilots.

Aeronautical Gallery Plans

IMAGINATIVE plans have been drawn up by the keepers of the Aeronautical Collection at the Science Museum, South Kensington, for its layout in the aeronautical gallery on the top floor of the new Science Museum Centre Block when this is completed. This new location will give the first opportunity of showing the collection almost in its entirety and in conditions far more suitable for display purposes than the present cramped space (in the western galleries of the Imperial Institute) allows.

A brochure has been prepared describing and illustrating these plans. Written primarily for circulation to the aircraft industry, it seeks to enlist the industry's co-operation in the reorganization project, either financially or by the loan or presentation of objects for exhibition. It is estimated, on experience gained with the reorganization of other museum galleries, that at least £30,000 will be required to produce a comparable standard. The Government's contribution (by provision of building and furniture) will amount to nearly £200,000.

Farnborough Guidance

THIS year's S.B.A.C. exhibition and flying display at the Royal Aircraft Establishment airfield at Farnborough, Hants, opens on September 7 with a Press and technicians' preview day. The following three days (Tuesday to Thursday, Sept. 8-10) are reserved for Society of British Aircraft Constructors' guests; and the public days are Friday, Saturday and Sunday, Sept. 11-13. The airfield gates are open each day from 10 a.m. to 7 p.m., and flying starts at 3 p.m. on the public days.

Admission charges on the Friday are £1 for adults and 10s for children under 14 and parking fees £1 for cars or motor coaches, 5s for motor cycles and 2s 6d for bicycles (all these fees being exclusive of admission charges). Advance bookings may be made at the usual agencies or from Auto-Parks Ltd., 1 Maclise Road, London, W.14 (Tel. SHE 5385-6-7).

No advance bookings can be made for the Saturday and Sunday, when admission charges are 5s for adults, 2s 6d for children under 14 and 30s for private cars, inclusive of up to six occupants (excess passengers being charged at the normal rate). Parking fees on these last two days are 10s for motor coaches, 2s 6d for motor cycles and 1s for pedal cycles.

A MINER, FIFTY-NINER: Subject of a news paragraph on this page is this startling new variant of the Scottish Aviation Twin Pioneer (two Alvis Leonides) for the Rio Tinto geophysical survey. Hunting Geophysics Ltd. are to operate it with Mullard electro-magnetic equipment

IN BRIEF

The 2,000th flight by a Lightning was made from the English Electric airfield at Warton on August 14 by Mr. J. C. Hall, one of the company's test pilots.

Mr. R. E. Bird, chief designer of Auster Aircraft Ltd. since 1947 and a director since March 1957, has joined F. G. Miles Ltd. as manager, special project design division.

Mr. F. W. Page, chief executive of the aircraft division of English Electric Aviation Ltd., is to lecture to the Radar and Electronics Association on October 27 on *Electronics in Supersonic Flight*, with special reference to the Lightning. The lecture is being given at 7.30 p.m. at the Royal Society of Arts, John Adam Street, Adelphi, London, W.C.2.

A four-Hunter team and a solo Hunter from No. 74 Sqn. are performing in the R.A.F.A. display at Wolverhampton tomorrow (Saturday). A Vampire, two Jet Provosts, Valiant, Canberra and Dragonfly helicopter are also participating and a similar R.A.F.A. display (with the exception of the Hunter) is being given on the same day at Colwyn Bay.

S.B.A.C. university scholarships have been awarded to W. T. Anderson (Short Bros.), K. H. Champion (Bristol Siddeley), B. Maskew and B. R. Perkin (Blackburn), D. F. Pilkington and W. G. Roberts (A. V. Roe) and M. G. Thomas (Hawker). Messrs. Anderson, Maskew, Perkin, Roberts and (subject to his acceptance after obtaining an external B.Sc.) Thomas will go to the College of Aeronautics and Messrs. Champion and Pilkington to Imperial College, London.

"FLIGHT" AND FARNBOROUGH

THE next three issues of *Flight* are special numbers of outstanding interest. They are:—

September 4: "Britain's Aircraft Industry". A detailed, specially illustrated review of British aircraft, engines and components, including a directory to the products and services of several hundred firms.

September 11: "Farnborough Report". A first-hand report on the aircraft and flying demonstrations at the opening of the show.

September 18: "Farnborough Review". The rest of the show-week news and pictures together with a further survey of technical innovations. Regular features will appear in this and the other Farnborough numbers.

Demand for these special issues is always heavy, so advance orders to newsagents are strongly advised. The greatly enlarged September 4 issue will sell at 2s 6d, the other two at the normal price of 1s 6d.

Missiles and Spaceflight . . .

THE LONDON SPACE CONFERENCES

CHURCH HOUSE, Westminster, is the scene this week and next week of two major spaceflight meetings. The first, which is now in session, is the first Commonwealth Spaceflight Symposium, to be followed next week (August 30-September 5) by the tenth congress of the International Astronautical Federation. In connection with the I.A.F. congress a space law colloquium, at which some 20 papers are to be presented, will take place in the Great Hall of Lincoln's Inn on Friday, September 4.

Both major meetings are organized by the British Interplanetary Society. According to the advance programme for the Commonwealth symposium (printed below), 16 of the 19 papers are by U.K. authors, with the remaining contributions from Australia, Canada and India. Among the papers due to be presented yesterday were *Astronautics at Armstrong Whitworth*, by H. R. Watson, Sir W. G. Armstrong Whitworth Aircraft Ltd., and *An Air-breathing Engine to Work at Mach Numbers Greater than Five*, by W. F. Hilton of Hawker Siddeley Aviation.

Mr. Watson's paper gave an account of work carried out during the past two years by a small team at Armstrong Whitworth, who took as their starting point Dr. Hilton's paper on re-entry problems given at the Cranfield symposium on rockets and satellites in 1957. From the circular-planform vehicle proposed in Dr. Hilton's 1957 paper the team went on to examine other designs suitable for a complete manned-flight sequence of launching, orbital flight at altitudes up to 500 miles, re-entry from a speed of about five miles per second, gliding flight and landing.

An early scheme employed a narrow-angle delta having a wing of low thickness and a blunted nose. A single pilot was housed in a semi-elliptical compartment mounted on the upper surface.

Consideration was also given to a rectangular wing with low aspect ratio triangular fins extending right along the tip chords, so that the pilot's compartment could be placed on the upper wing surface, at the bottom of an H-section of tapering depth.

The final design (see diagrams, page 68) retains the delta planform with a flat lower surface and an upper portion of a pyramid type. This proposal came from Mr. T. R. F. Nonweiler of Queen's University, Belfast, who has acted as a consultant on the project for the past twelve months.

Although perhaps only indirectly concerned with spaceflight, the paper presented by Dr. W. F. Hilton explored a number of air-breathing powerplants of singular interest and bold conception. Essentially, he based his arguments upon the belief that it is not essential to decelerate to subsonic speed the air entering a supersonic ramjet in order to allow controlled, stable combustion to take place. In fact, the inclined shocks from the sharp leading edges of the duct are actually employed as flameholders.

A progressive series of advances led to an intake having an octagonal form, within which, at the design Mach number of 7.4, the overlapped shock waves compress the air to 315 times ambient and result in a temperature of some 1,000 deg C—sufficient to cause spontaneous combustion of fuel injected across the airflow ahead of the shock system. The flow would never be subsonic, and minimum Mach number would be approximately 2.31 before combustion and 1.44 behind, temperature rising through the shock system from 218 deg K ahead of the intake to 1,260 immediately before combustion, assuming flight at 100,000ft. Behind the point of minimum cross-section the duct would expand as a tailpipe in which the gas would accelerate to the final nozzle (supersonic flow accelerates in an expanding duct).

Assuming a delay in ignition of 0.001 sec (so that combustion would take place 5ft behind the shock confluence), Dr. Hilton suggested a minimum size of engine to be 4ft diameter and 32ft in length. If such a unit were made largely in 18-gauge sheet steel it would weigh some 1,148 lb dry; the volume enclosed between the inner and outer walls might amount to 220.6 cu ft, and the 1,373 gal of kerosine (this is the fuel assumed) which could be accommodated would weigh a further 11,000 lb. A thermal efficiency of 63.5 per cent had been calculated for the engine.

COMMONWEALTH SPACEFLIGHT SYMPOSIUM

Thursday, August 27. *Altitude Sounding by Solid Propellant Rockets and its Economics*, W. T. Fisher (Bristol-Aerojet); *Minimum Propulsion for Soft Moon Landing of Instruments*, D. S. Carton (College of Aeronautics); *Astronautics at Armstrong Whitworth*, H. R. Watson (Armstrong Whitworth Aircraft); *Instrumentation for Spaceflight*, B. V. Soames-Charlton, L. Lax and P. Barrett (Pye); *Jodrell Bank Radio Telescope as a Space Communicator*, J. H. Thomson (University of Manchester); *Britain's Place in Interplanetary Exploration*, J. E. Allen (A. V. Roe); *An Air-breathing Engine to Work at Mach Numbers Greater than Five*, W. F. Hilton (Hawker Siddeley Aviation).

Friday, August 28. *Cabin Conditioning Equipment for Manned Satellites*, B. Beardshall and P. Fitt (Normalair); *General Review of a British Spaceflight Project based on Blue Streak*, G. K. C. Pardoe (de Havilland Propellers); *Economics of Spaceflight*, D. Wragge-Morley (*Financial Times*); *Space Navigation*, P. R. Wyke (A. V. Roe); *Satellite Tracking by Optical Methods*, A. P. Willmore (University College, London); *Woomera as a Space-vehicle Tracking and Launching Station*, H. J. Higgs (Ministry of Supply, Australia); *Heating Problems of Entry into Planetary Atmosphere*, D. J. Shapland (A. V. Roe); *Commonwealth University Participation*, T. R. F. Nonweiler (Queen's University, Belfast.

Saturday, August 29. *Recovery of Earth Satellites*, D. E. Bailey (A. V. Roe); *Initial Programme for Commonwealth Spaceflight Project*, S. K. Kumar and R. L. Macarthy (Indian Astronautical Society); *Canadian Facilities*, E. Wall (de Havilland Aircraft of Canada); *Feasibility of Nuclear Fission Rockets*, O. H. Wyatt (Hawker Siddeley Nuclear Power).

INTERNATIONAL ASTRONAUTICAL CONGRESS

Launching Parameters and Geometry of Orbits, Fang-Toh Sun; *The Great Danger: Corpuscular Rays from the Sun*, C. E. Andersen; *Etude D'un Echangeur de Chaleur A Haute Temperature par Convection et Rayonnement pour un Autopropulseur Fissiothermique*, E. A. Brun and P. Berrier; *Limitation du Gain des Aeriens*, G. Gallede; *Mesure des Rendements de Combustion des Melanges Propergoliques*, L. Reingold; *Sur Deux Types des Propulseurs Electriques*, J. Ulam; *Les Limites de la Survie en Cabine Etanche au Cours des Voyages Interplanétaire*, F. F. Violette, M. Boiteau and S. Bernard; *Schwingungen von Raketen beim Eintauchen in die Atmosphere*, R. Merten; *On Directing Intensive Photon Beams*, E. Sanger; *Thermonuclear Research and Propulsion*, H. J. Kaeppeler.

Design Study of an Earth Satellite Evolving from a Four-step Solid Propellant Rocket Vehicle, S. K. Kumar and B. R. Rav; *Development of Space Crew Selection Procedures*, D. Flickerenger; *Third Kepler Law as a Particular Case of the Time Law of Omothetical Gravitational Trajectories*, G. Boffa; *Space Communications and Characteristics of their Channels*, A. Boni; *Installation and Operation of a Permanent Base for Scientific Research on Mars*, G. Botti and P. Maimi; *Jet Orbital Lift for High Velocity Transport*, C. E. Cremona and D. Cunsola; *Compressible Boundary Layer of an Electrically Conducting Fluid*, L. G. Napolitano; *Some Functions of Mass Ratio Relevant for the Relativistic Velocity*, E. Ostinelli; *Postal Service by Automatic Rockets*, G. Partel, A. Angeloni and P. Carusi; *Theory of the n-step Relativistic Rocket*, M. Subotowicz.

Technical Realisation of Weightlessness and Subgravity, O. Wolczek; *Experiments on the Biological Effects of Cosmic Radiation on Seeds of Hordeum (Gold Barley) Bonus 01515/B 19 (Gustafson) with Special Consideration of Heavy Primaries Effects*, Prof. Eugster and D. Simmons; *Practical Investigation of Spaceship Control Problems*, C. A. Cross; *Data From Satellite Orbits*, G. V. Groves; *Re-entry Paths for Manned Satellites*, W. F. Hilton; *Accuracy Limits in Electronic Tracking of Space Vehicles*, von Handel and Hochudorf; *Determination of Air Density and Earth's Gravitational Field from Orbits of Artificial Satellites*, D. G. King-Hele; *Potentiality of Blue Streak in a British Space Flight Programme*, G. K. C. Pardoe; *Fuel Requirements for Interorbital Transfer of a Rocket*, R. N. A. Plummer; *Line-of-Sight Criteria for Interplanetary Navigation*, T. Connors, A. Lawson, W. Huggett and G. Rassweiler.

Lunar Exploration by Photography from a Space Vehicle, M. E. Davies; *Drag Brake Manned Satellite System*, R. W. Detra, A. R. Kantrowitz, F. R. Riddell and P. R. Ross; *Introduction and Integration of the Human into Very Advanced Aircraft*, R. R. Held; *Ionospheric Scintillations of Satellite Signals*, H. P. Hutchinson and P. R. Arendt; *Application of Magnetohydrodynamics to Astronautics*, A. R. Kantrowitz; *Observation Satellites: Problems, Possibilities and Prospects*, A. H. Katz; *Optimum Operation of a Nuclear Rocket*, G. Leitmann; *Satellite Perturbations Resulting from Lunar and Solar Gravitational Effects*, E. Levin; *Magnetohydrodynamics and its Application to Propulsion and Re-entry*, R. X. Meyer; *Flight Path of a Hyper-velocity Glider Boosted by Rockets*, A. Miele.

Tracking Objects Within the Solar System Using Only Doppler Measurements, R. R. Newton; *Path Control for Satellite Rendezvous*, R. E. Roberson; *Topological Transforms Applied to Equations of Rocket-Powered Flight*, R. E. Ross; *Minimum Energy Requirements for Space Travel*, H. O. Ruppe; *Studies on the VIII Cranial Nerve of Biological Subjects During Weightlessness and Multiple g-Loads*, G. J. D. Schock and F. R. Steggarda; *The Biological Satellite*, R. P. Havilland; *Secular Variation in the Inclination of the Orbit of Earth Satellite 1957β*, L. N. Rowell and M. C. Smith; *Application of Solid Propellants to Spaceflight Vehicles*, H. L. Thackwell; *Predicting Man's Performance in Space through Flight Simulators and Balloon-borne Systems*, J. G. Vaeth; *Nuclear Rocket Missions and Associated Power Plants*, J. J. Newgard and M. Levoy.

Problems of Magnetic Propulsion of Plasma, R. W. Waniek; *Green Areas of Mars and Color Vision*, I. Schmidt; *Weight Energy Concept of Man in Space*, H. G. Clamann; *Experiments in Space Cabin Simulators*, G. R. Steinkamp, W. R. Hawkins and G. T. Hanty; *Reaction of Terrestrial Microorganism to Simulated Martian Conditions*, I. Davis and J. D. Fulton; *The Human Eye in Space*, H. Strughold; *Biophysical Factors in a Human Lunar Ecosystem*, T. C. Helvey; *Thrust from a Controlled Thermonuclear Reactor*, M. D. Greyber; *Corridor and Associated Trajectory Accuracy for Entry of Manned Space-craft into Planetary Atmospheres*, D. R. Chapman; *Motion of an Orbiting Vehicle Subjected to Continuous Radial Thrust including a study of Planetary Encounters*, B. Paiewonsky.

Measurement of Jupiter Re-entry Radiation, D. D. Woodbridge and W. N. Arnquist; *Space Power*, W. W. T. Crane; *Effects of a Meteoroid*

Impact on Steel and Aluminium in Space, R. L. Byork; *Multi-directional g-Protection During Experimental Sled Runs*, H. J. von Beckh; *Study of Hypersonic Ablation*, S. M. Scala; *Interplanetary Navigation*, I. Suira; *Sur le danger Meteorique en Astronnautique*, N. Boneff; *Apparent Motion of an Earth's Artificial Satellite*, J. J. de Orus; *Etude de la Fusée du Point De Vue Rélativité*, V. R. Altet.

Trajectories in the Earth-Moon System, S. Goldblatt; *Impact of Spaceflight on World Economy*, T. P. Bun; *Interplanetary Homing*, E. V. Stearns; *Nova, A Rocket for Manned Lunar Exploration*, M. W. Rosen and F. C. Schwenk; *Unsteady Comprehensible Magnetic Laminar Boundary Layers in Hypersonic Flow*, P. S. Lyyoudis and J. P. Schmitt; *Impulsive Midcourse Correction of an Interplanetary Transfer*, R. J. Gunkel, D. N. Lascody and D. S. Merrilees; *Design Compromises in Space Power Systems*, M. A. Zipkin and E. Schnetzer; *Differential Expressions for Low-Eccentricity Geocentric Orbits*, S. Herrick, L. G. Walters and C. G. Hilton; *New Methods of Satellite Orbit Calculation*, H. Knothe; *Sterilization of Space Vehicles to Prevent Extraterrestrial Biological Contamination*, R. W. Davies and M. Comuntzis.

BOOSTERS AND RELATIVITY

Recent contracts awarded by the U.S. National Aeronautics and Space Administration include initial funding for eight modified Atlas boosters for the three-stage Vega ($7.5m to the Air Force Ballistic Missile Division) and for eleven Thors for the three-stage Delta ($5.87m, also to B.M.D.). Other projects to receive financial support from NASA were for a lunar seismograph (Columbia University and California Institute of Technology); a plug-nozzle rocket engine (General Electric Co.); a feasibility study of a classified "unique design of solid-propellant rocket engine" (Grand Central Rocket Company); engineering studies of instrumenting an orbiting telescope (Smithsonian Institution); and design and construction of an atomic clock, using ammonia vapour, which may be used to test Einstein's Theory of Relativity regarding time variations in space.

MIDAS BASE FOR SCOTLAND?

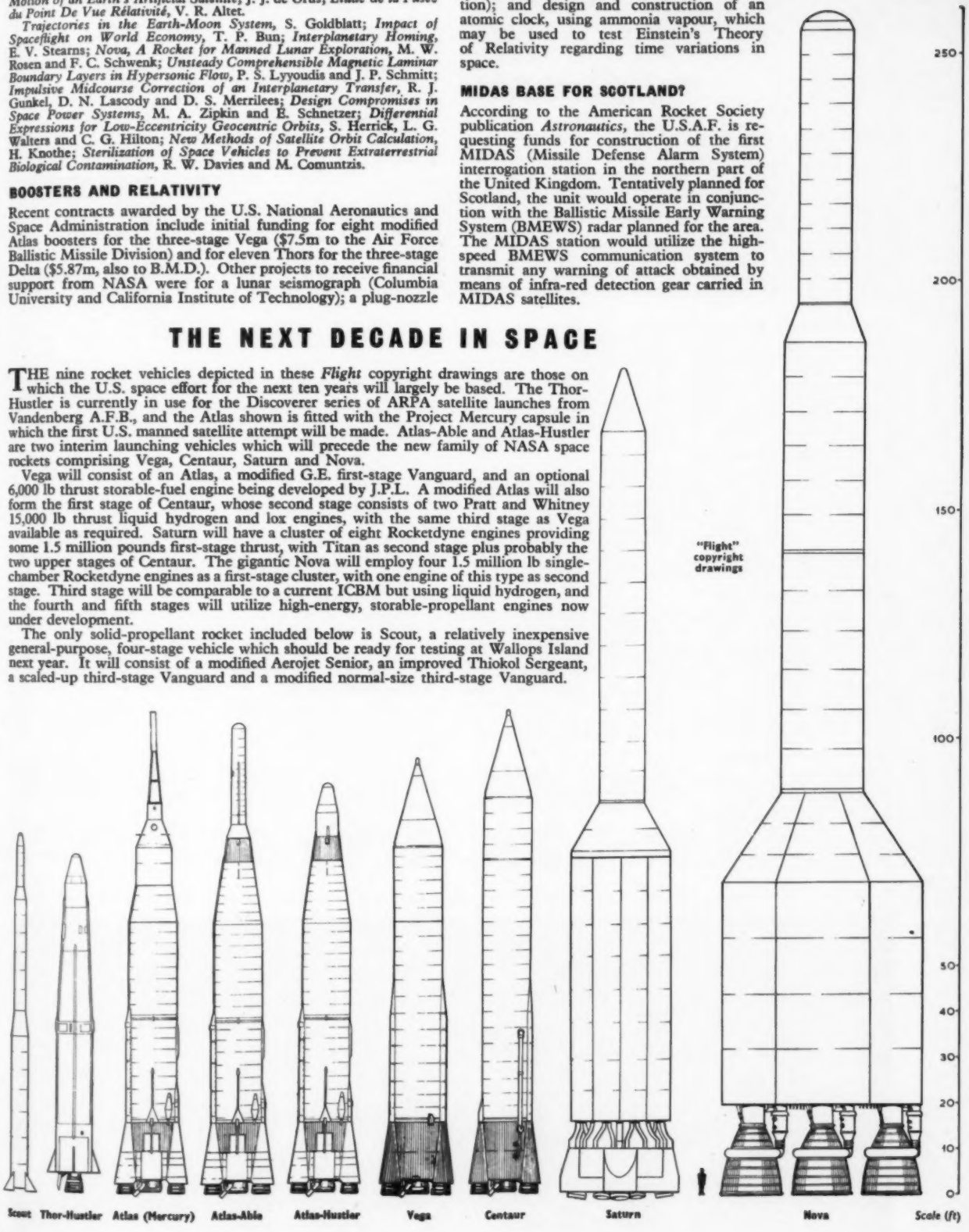
According to the American Rocket Society publication *Astronautics*, the U.S.A.F. is requesting funds for construction of the first MIDAS (Missile Defense Alarm System) interrogation station in the northern part of the United Kingdom. Tentatively planned for Scotland, the unit would operate in conjunction with the Ballistic Missile Early Warning System (BMEWS) radar planned for the area. The MIDAS station would utilize the high-speed BMEWS communication system to transmit any warning of attack obtained by means of infra-red detection gear carried in MIDAS satellites.

THE NEXT DECADE IN SPACE

THE nine rocket vehicles depicted in these *Flight* copyright drawings are those on which the U.S. space effort for the next ten years will largely be based. The Thor-Hustler is currently in use for the Discoverer series of ARPA satellite launches from Vandenberg A.F.B., and the Atlas shown is fitted with the Project Mercury capsule in which the first U.S. manned satellite attempt will be made. Atlas-Able and Atlas-Hustler are two interim launching vehicles which will precede the new family of NASA space rockets comprising Vega, Centaur, Saturn and Nova.

Vega will consist of an Atlas, a modified G.E. first-stage Vanguard, and an optional 6,000 lb thrust storable-fuel engine being developed by J.P.L. A modified Atlas will also form the first stage of Centaur, whose second stage consists of two Pratt and Whitney 15,000 lb thrust liquid hydrogen and lox engines, with the same third stage as Vega available as required. Saturn will have a cluster of eight Rocketdyne engines providing some 1.5 million pounds first-stage thrust, with Titan as second stage plus probably the two upper stages of Centaur. The gigantic Nova will employ four 1.5 million lb single-chamber Rocketdyne engines as a first-stage cluster, with one engine of this type as second stage. Third stage will be comparable to a current ICBM but using liquid hydrogen, and the fourth and fifth stages will utilize high-energy, storable-propellant engines now under development.

The only solid-propellant rocket included below is Scout, a relatively inexpensive general-purpose, four-stage vehicle which should be ready for testing at Wallops Island next year. It will consist of a modified Aerojet Senior, an improved Thiokol Sergeant, a scaled-up third-stage Vanguard and a modified normal-size third-stage Vanguard.



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Missiles and Spaceflight . . .

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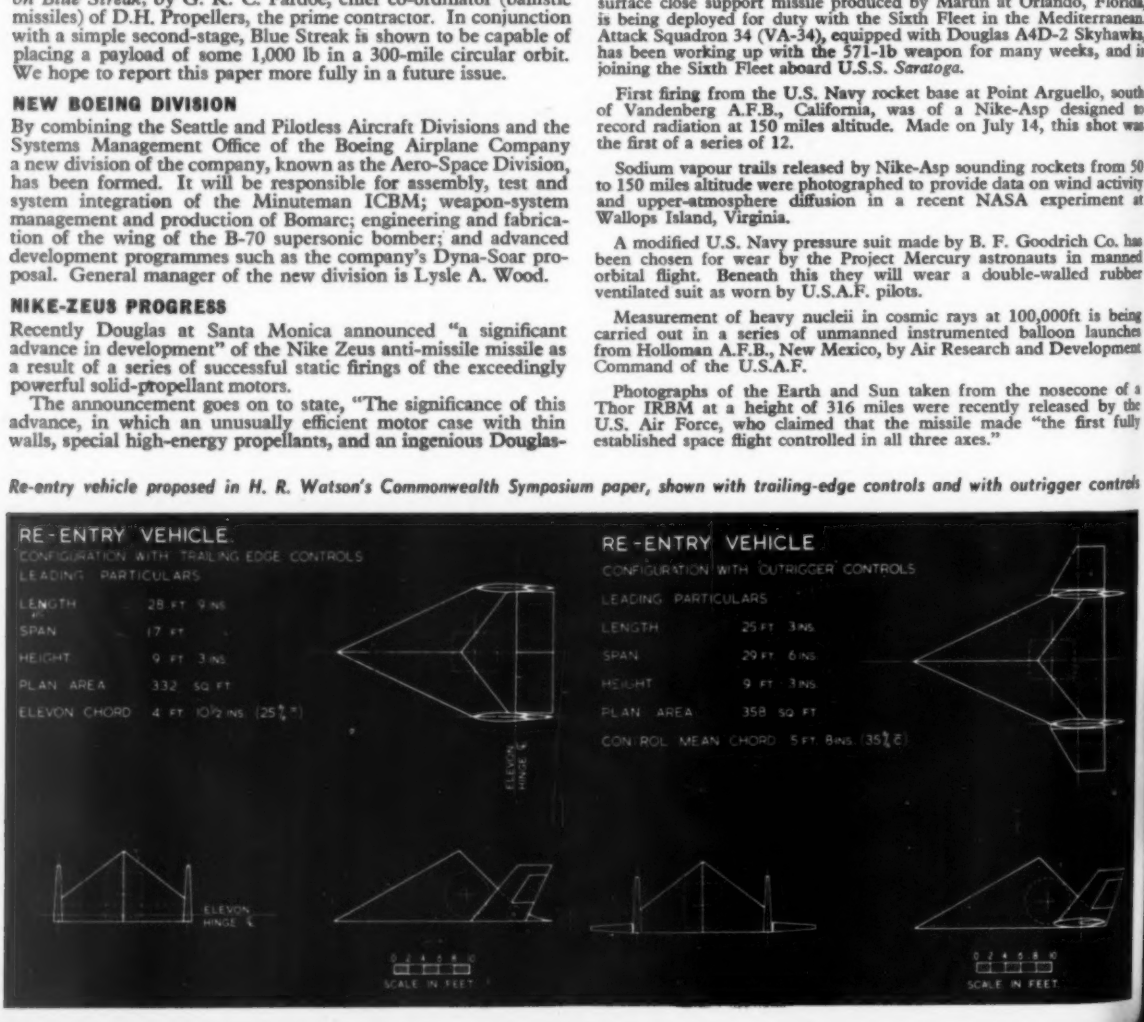
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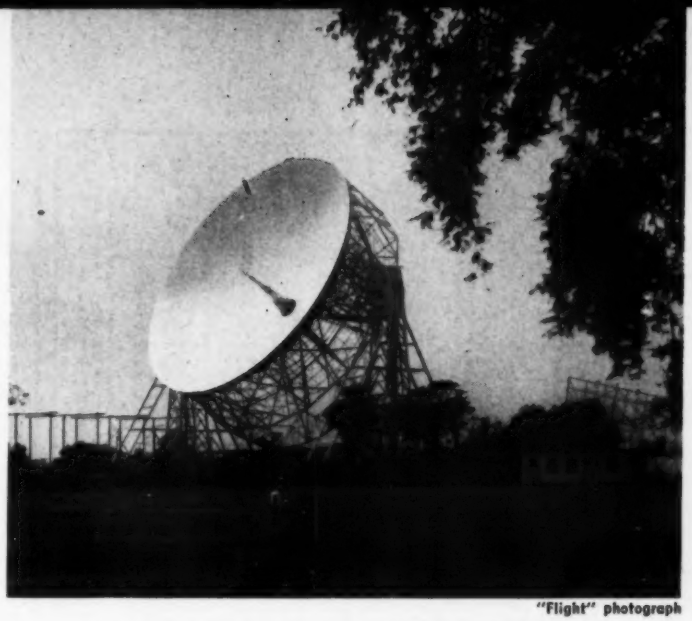

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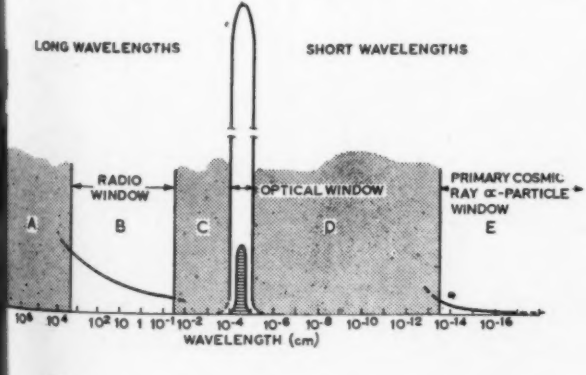

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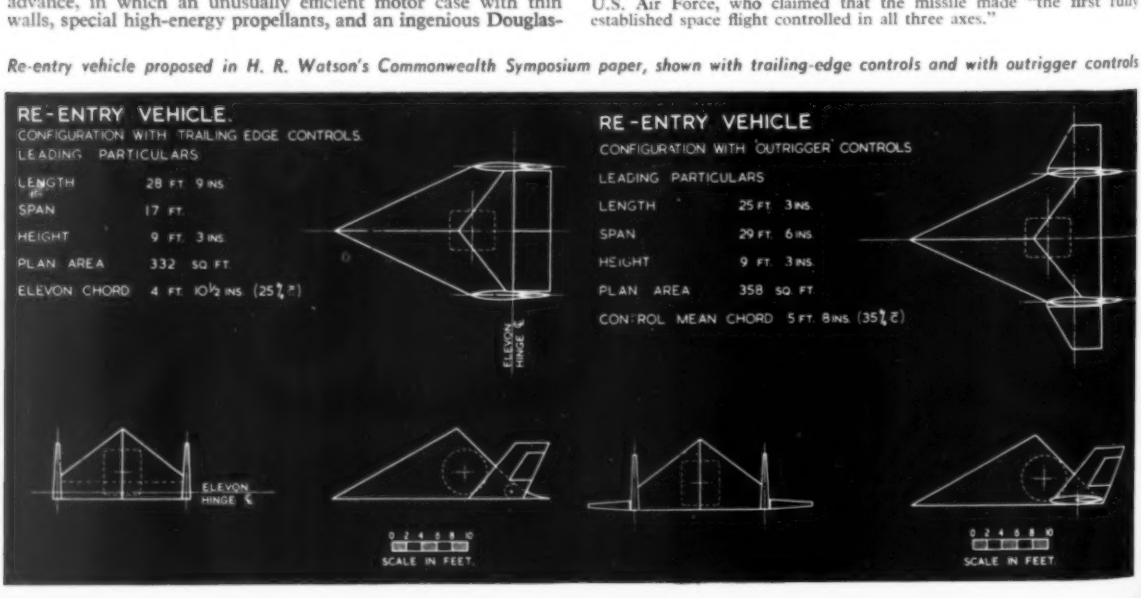
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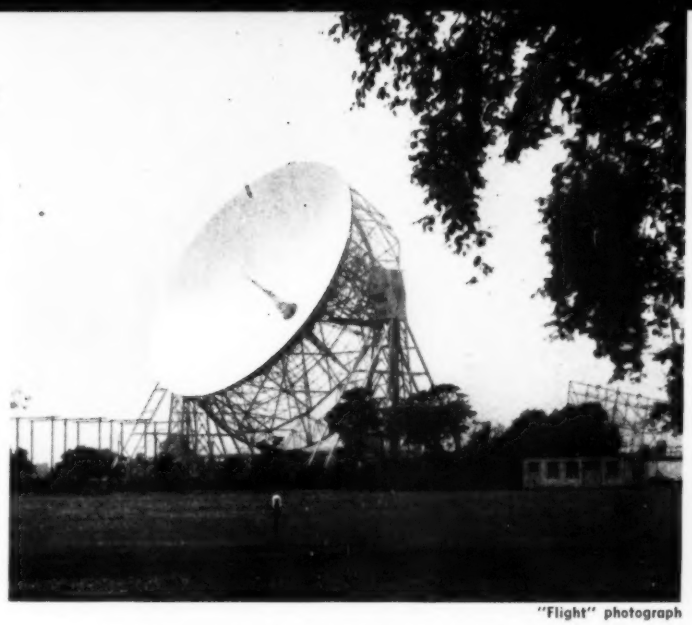

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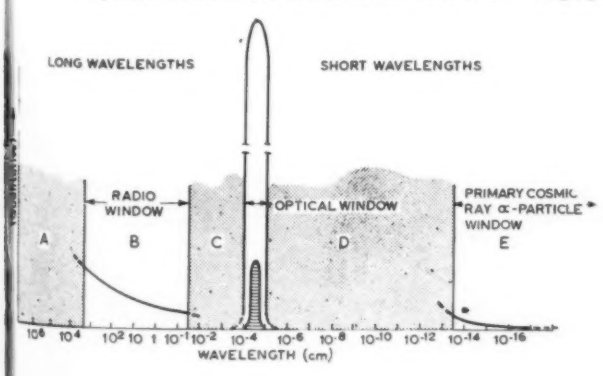

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SATELLITES AND PROBES: A QUICK-REFERENCE HISTORY

Satellite	Launching vehicle	Date launched	Expiry or lifetime	Shape	Payload (lb)	Incln. (deg)	Orbit (miles)	Period (min)	Experiments	Radio (Mc/s)	Remarks
Sputnik 1 (U.S.S.R.)	undisclosed	Oct. 4, 1957	Jan. 4, 1958	sphere	184	65	142-588	96.17	internal temp., press.	20.005 40.002	batteries stopped Oct. 27, 1957
Sputnik 2 (U.S.S.R.)	undisclosed	Nov. 3, 1957	Apl. 14, 1958	complex	1,120	65	140-1,038	103.7	cosmic rays, solar u-v. and X-rays, test animal (dog Laika) temp., press.	20.005 40.002	batteries stopped Nov. 10, 1957; satellite acceln. led to discovery of solar influence on upper-atmos. density
Explorer 1 (U.S.A.)	Jupiter C	Jan. 31, 1958	3-5 yr est.	cylinder	30.8 (18.13)	33.34	224-1,573	114.8	cosmic rays, micrometeorites, internal and shell temps.	108 108.03	discovery of first Van Allen radiation belt
Vanguard 1 (U.S.A.)	Vanguard	Mar. 17, 1958	200 yr est.	sphere	3.25	34.25	409-2,453	133.7	temps., geodetic data	108 108.03	mercury batteries stopped Apl. 5, 1958; solar batteries should power radio indefinitely
Explorer 3 (U.S.A.)	Jupiter C	Mar. 26, 1958	June 27, 1958	cylinder	31 (18.56)	33.4	121-1,746	115.87	cosmic rays, micrometeorites, internal and skin temps.	108 108.03	data on Van Allen belt, micrometeorite impacts
Sputnik 3 (U.S.S.R.)	undisclosed	May 15, 1958	19 mths est.	conical	2,925	65.3	135-1,167	105.95	atmos. press. and composition, positive ions, electrostatic charge and field, Earth's magnetic field, solar corpuscular radiation, cosmic rays, micrometeors, temps.	20.005 40.01	chemical and solar batteries
Explorer 4 (U.S.A.)	Jupiter C	July 26, 1958	1 yr est.	cylinder	38.4 (25.8)	50.29	163-1,380	110.27	corpuscular radiation, internal temp.	108 108.03	radiation belt data
Project Score (U.S.A.)	Atlas	Dec. 18, 1958	Jan. 21, 1959	Atlas shell	8,750 (150)	32.3	110-920	101.46	radio transmit, record and receiving apparatus	132.435 132.905 107.97 107.94	satellite received, recorded and re-transmitted voice messages from ground stations
Vanguard 2 (U.S.A.)	Vanguard	Feb. 17, 1959	10 yr est.	sphere	20.74	32.88	347-2,064	125.85	cloud cover by photocells	108 108.03	instrumentation functioned, but satellite's wobbling motion made data interpretation difficult
Discoverer 1 (U.S.A.)	Thor-Hustler	Feb. 28, 1959	Mar. 5, 1959	cylinder	1,300 (245)	87	99-605	95.9	checkout of propulsion, guidance, staging, communications	classified	stabilization difficulty hampered tracking
Discoverer 2 (U.S.A.)	Thor-Hustler	Apl. 13, 1959	Apl. 26, 1959	cylinder	1,610 (245)	89.8	142-220	90.5	capsule re-entry and recovery	classified	capsule ejection timer malfunction caused capsule impact near Spitzbergen instead of Hawaii on Apl. 14
Explorer 6 (U.S.A.)	Thor-Able 3	Aug. 7, 1959	1 yr est.	spheroid	142	48	157-26,400	766	high-, medium- and low-level radiation, micrometeorites, magnetic field, facsimile scanner, radio propagation, internal and surface temp. measurement, internal temp. control, solar cells	108.06 108.09 undisclosed UHF	digital telemetry stores data, transmits on ground command; four 20in × 20in solar-cell vanes for battery charging; auxiliary 5 lb thrust solid rocket carried but unused
Discoverer 5 (U.S.A.)	Thor-Hustler	Aug. 13, 1959	1 month est.	cylinder	1,700 (300)	appx. 90	136-450	94	capsule re-entry and recovery	classified	capsule ejected but not located following "malfunction of sequencing telemetry signals"
Discoverer 6 (U.S.A.)	Thor-Hustler	Aug. 19, 1959	1 month est.	cylinder	1,700 (300)	appx. 90	200-500	95	capsule re-entry and recovery	classified	capsule ejected but not located

MAIN DETAILS of all the successful artificial Earth satellites and space probes launched up to August 21, 1959 are presented in these two tables, which have been compiled from official U.S. and Soviet sources. The "orbit" column lists the initial perigee and apogee, and the period quoted is the initial period of the satellite.

The payload quoted is normally the total weight of the object concerned, with the weight of scientific equipment given in parentheses where known. Designation of the Mechta launching vehicle is unofficial. Launchings up to the end of 1958 formed part of International Geophysical Year activity; current U.S. launchings are by the National Aeronautics and Space Administration (Vanguard, Explorer, Pioneer) and the Advanced Research Projects Agency of the Department of Defense (Discoverer).

Probe	Launching vehicle	Date	Expiry or lifetime	Shape	Payload (lb)	Distance (miles)	Experiments	Radio (Mc/s)	Remarks
Pioneer 1 (U.S.A.) lunar probe	Thor-Able 1	Oct. 11, 1958	43 hr 17.5 min	toroidal	84.4 (39)	70,700	radiation, magnetic fields of Earth and Moon, micrometeor density, internal temp., electronic scanner	108.06	determined radial extent of radiation band, mapped ionizing flux, observed hydromagnetic oscillations of Earth's magnetic field, discovered magnetic field discrepancy with theory, determined micrometeor density and measured interplanetary magnetic field
Pioneer 2 (U.S.A.) lunar probe	Thor-Able 1	Nov. 8, 1958	42.4 min	toroidal	86.4 (34.3)	963	total ionizing radiation, cosmic ray flux, others as Pioneer 1	108.06 108.09	third stage failed to ignite; probe obtained data on flux, radiation, micrometeor density
Pioneer 3 (U.S.A.) space probe	Juno 2	Dec. 6, 1958	38 hr 6 min	conical	12.95	63,580	measurement of radiation in space	960.05	discovered second radiation belt; designed velocity, 24,897 m.p.h.; attained velocity, about 24,000 m.p.h.
Mechta or Lunik (U.S.S.R.) space probe	T-3	Jan. 2, 1959	indefinite	spherical	3,245 (797)	in orbit round Sun	internal temp. and press., gas components of interplanetary matter, corpuscular radiation of Sun, magnetic fields of Earth and Moon, meteoric particles in space, cosmic rays	19.997 19.995 19.993 183.6	in orbit round Sun on 450-day cycle; sodium flare released and photographed from ground; probe passed within "two lunar diameters" (about 4,300 miles) of Moon; radio contact held for 62 hr; perihelion 90.9m miles, Jan 14, 1959; aphelion (est.) 122.5m miles, Sept. 1959
Pioneer 4 (U.S.A.) space probe	Juno 2	Mar. 3, 1959	indefinite	conical	13.4	in orbit round Sun	measurement of radiation in space, test photoelectric sensor near Moon	960.05	passed within 37,300 miles of Moon, not close enough (20,000 miles) to trigger photoelectric sensor nor sample Moon's radiation. Tracked for 82 hr to 407,000 miles; perihelion 91.7m miles, Mar. 17, 1959; aphelion (est.) 106.1m miles, Oct. 1, 1959; injection velocity of 24,790 m.p.h. was 188 m.p.h. below planned velocity

Missiles and Spaceflight

MAPPING OUTER SPACE . . .

telemetered data was obtained. Pioneer 4 was tracked to a distance of about 400,000 miles before its batteries became exhausted.

Prior to a space-probe launch, details of the expected trajectory are supplied to Jodrell Bank from the U.S.A. In the case of a lunar-probe firing from Cape Canaveral the probe would appear over the Jodrell horizon to the south-west and be picked up by the radio telescope about ten minutes after launching, after which it would take a further 20 min to attain an elevation of some 30 deg to the south. The exact position of the probe is checked at ten-minute intervals by moving the telescope off track and scanning back through the maximum-intensity position, in both azimuth and elevation. The co-ordinates at which the maximum signal is received indicate the angular position of the probe with an accuracy which depends on the beamwidth and hence on the frequency. At a frequency of 1,000 Mc/s the beamwidth is 20 min of arc and the probe can be located to within a few minutes of arc.

Satellites and probes, although perhaps the most publicized interest of the Jodrell Bank establishment, are not its main concern. As a university department possessing the world's most powerful radio-astronomical tool of its type, Prof. Lovell's group is basically concerned with exploring and mapping the vast spaces of the universe. There are several areas, however, in which data from satellites and probes are of direct use in these basic studies.

The resident group concerned with satellites at Jodrell Bank, led by Dr. John Thomson, works closely together with Dr. John Evans' team responsible for Moon and planetary echo research. The reception of signals from Vanguard 1 (whose solar-powered transmitters are expected to continue to operate indefinitely) is providing detailed information on the nature of the ionosphere. including a study of the way in which the polarization plane of these signals rotates in passing through the ionosphere. This phenomenon was first observed in radio echoes from the Moon. In addition, much of the telemetered information from space probes (the prime concern of the U.S. team at Jodrell) is relevant to the station's basic research, in fields such as micrometeorite experiments, radiation and magnetic fields and cosmic ray intensity.

In much of their normal programme of work the Jodrell Bank scientists are looking a long way ahead of the satellites and space-probes. In one of the small buildings, for instance, a radio "contour map" of the Andromeda galaxy, some 1½ million light-years distant, is being built up from simultaneous traverses across the galaxy on three frequencies. This is part of a broad study of the position, distance, size, distribution and origin of radio sources both inside our own Milky Way system and in extra-galactic space. Specific investigations include an examination of the galaxies on the frequency of the hydrogen line (a radio emission from neutral hydrogen gas), which enables the motion of hydrogen clouds to be studied.

Nearer to Earth, a number of ionospheric and other projects on which much work was done during the International Geophysical Year are being continued, with certain changes in emphasis. The subjects include the scintillation or twinkling of radio stars, the drift of meteor trails in the E region (about 100 km altitude), a monitoring of solar phenomena on three frequencies, and radar studies of auroræ and of the ionized trails of meteors entering the atmosphere.

In most of these programmes the massive steerable radio telescope plays an important part. Its time is allocated to the various projects according to a pre-arranged schedule, and the instrument normally works a 24-hour day (including maintenance and aerial changing between experiments). At the time of *Flight's* visit to Jodrell Bank recently a twelve-hour period of measuring the angular diameter of radio sources with the bowl in the fixed position (i.e., making a transit with the Earth's revolution) was followed by a survey of one discrete source.

William Young (right), of Space Technology Laboratories, leader of the U.S. team at Jodrell Bank, talking to R. G. Lascelles, special assistant to the director "Flight" photograph

Professor A. C. B. Lovell, director of the Jodrell Bank station and Professor of Radio Astronomy at Manchester University. The model is of Pioneer 1, and seen through the window is the vast structure of the 250ft steerable radio telescope

From the control room in the centre of the low brick building about 200yd from the telescope, the movement of the instrument is electronically controlled. Steering instructions are determined by an electronic analogue computer which solves the 14 different equations needed to give accurate control of the instrument over all parts of the sky.

To keep the telescope automatically trained on a star, for example, seven of these equations are used to translate the position and movement of the star, as given by the celestial co-ordinates of right ascension and declination, into terms of telescope azimuth and elevation. The remaining seven equations deal with the case of a scan along or across the Milky Way, for which the frame of reference is that of galactic latitude and longitude, which again must be expressed as a steering instruction to the telescope in terms of azimuth and elevation. Amplified signals determine the speed of the various electric motors which control the movement of the telescope through two Ward Leonard motor generator sets housed just above the central pivot bearing.

The steering of the telescope is carried out from the main controller's console, where a safety interlock system gives visual warning of the position of men who may be working on the telescope structure. About six feet away on each side of the control desk is a bank of 15 large dials. Those on the right of the controller show him the actual and computed positions of the telescope (elevation and azimuth); while on the left the dials indicate celestial co-ordinates (right ascension and declination) and galactic co-ordinates (galactic latitude and longitude). This information is accurate to at least one minute of arc; and universal and sidereal time are also displayed.

New achievements at Jodrell Bank this year have included the transmission of voice messages to Cambridge, Massachusetts, via the Moon; and the switching off and on of the telemetry transmitters in the "paddlewheel" satellite while in orbit by the S.T.L. team. In the near future it is hoped to reflect a radar echo from Venus.

To visit the skilled young practitioners of the young science of radio astronomy at Jodrell Bank, and to hear about their work, is to realize the incredibly vast new realm of knowledge which their thinking and experimental techniques are making possible. Radio astronomy already forms an important part of astronautics today, and Prof. Lovell himself has indicated the probable development over the next ten years.

"I believe the next decade in space research will see developments in astronomical work which were inconceivable only a short time ago," he said. "During this period one can confidently expect that both radio and optical telescopes will be carried on Earth satellites so that the universe can be studied from above the interfering regions of the Earth's atmosphere. One can even hope that remotely controlled telescopes may be operated from the Moon within this period. In connection with space probes, it seems clear that such vehicles will be able to approach and possibly sample the atmospheres and surfaces of some of the planets. The contributions which can be expected to result to our knowledge of the conditions and evolution of the solar system are at present almost incalculable."

Subsonic to Supersonic

AERONAUTIQUE MARCEL DASSAULT AND ITS ADVANCED AIRCRAFT

THE Générale Aéronautique Marcel Dassault, although privately owned, is one of the most potent aircraft and missile concerns in France. It periodically produces surprises, both commercial and technical. Shortly before the Paris Show I visited Dassault factories at Bordeaux and Paris and inspected the prototype Communauté, a pre-series Etendard IVM, and one of the pre-series Mirage IIIAs. During the show itself the Communauté would almost certainly have walked away with first prize in a *concours d'élégance*; the Etendard IVM seemed to dot the Is and cross the Ts of the classic attack fighter formula; the Mirage IIIs went one better on the performance of any other intercepter; and the Mirage IV took pride of place as Europe's first supersonic bomber. Not content with this, Dassault state almost casually that they could produce 40 examples per month of any fighter they are told to build; their flourishing electronics department has turned out half-a-dozen different fire-control radars; and the hottest rumour is that the company is to contribute largely to the production of France's long-range ballistic missile.

Backed by M. Marcel Dassault's own banking and other commercial concerns, GAMD has made a big financial investment in machinery and factory floor space, and its commercial acumen is such that even a late Dassault entry in an official design competition soon becomes hot favourite for an eventual order.

Early on the morning of June 17 the Mirage IV, after being delayed by modifications to the fin following pre-flight vibration tests, completed a successful 40-minute first flight from Melun Villaroche and it actually reached M1.9 on its 14th flight. It appeared in public on June 20 at Le Bourget.

On June 18 Dassault test pilot Gérard Muselli broke the Griffon's 100 km closed-circuit speed record in the third Mirage III flying from Melun Villaroche. He averaged 1,785 km/hr (1,109 m.p.h.) for the record, although he had apparently taken a wider course in an earlier attempt and averaged nearly 1,274 m.p.h. He had also maintained M2.05 for 4 min.

It is difficult to know where to begin in discussing the latest Dassault developments, especially because the different Dassault types are closely linked in structural and systems thinking. There is a remarkable cross-fertilization of ideas, and even the little Communauté has benefited to a considerable extent from the powered-controls, structural and aerodynamic ideas originally developed for the Mystères, Mirages and Etendards. The Mirage IV itself is very nearly a structural and aerodynamic extrapolation of the Mirage III.

For the moment, the most intriguing progress has been made in turning the Mirage III into a complete weapon system. Perhaps more than any other constructor, GAMD have succeeded in packing a military quart into an aerodynamic pint pot, and during the last year they have considerably improved the aerodynamic and military performance of the basic Mirage III.

The fifth pre-production aircraft reached Le Bourget towards the end of the Salon. It was still basically the same airframe, but it was the first to be truly representative of the production version and looked very different from its predecessors. Its wings now have a t/c ratio of 3.5 per cent and sport a pronounced conical camber, the result of intensive Dassault research on the original American innovation. At about two-thirds of each semi-span there is a slot fence and small trimming surfaces are added inboard of the elevons. The rear fuselage has been fitted with a "beak" fairing almost totally enclosing the afterburner eyelids of the more powerful SNECMA Atar 9 (13,227 lb thrust). The drag-parachute is stowed in a long bullet which continues the straight contour of the top fuselage. A short dorsal fin has been added, and the tip of the fin is cut off square.

When the SEPR 841 rocket-boost motor and oxidant tank-pack are not fitted under the rear fuselage, a ventral fin appears to be attached to the plain fuel tank which replaces the pack. Two 30-mm cannon and ammunition are carried in a further small pack within the forward fuselage. Distributed around the Mirage III in the static park were under-wing tanks, plastic napalm containers, Sidewinders, two Nord 5103 air-to-air or air-to-ground missiles, and the brand-new Dassault JL.100R combined fuel tank and rocket pack. This is an all-metal jettisonable unit in which the exhaust gases from the rockets are vented from openings around the container just ahead of the fuel section. After firing, a metal ring slides back to cover the exhaust ports. Several sizes are available and firing trials have been successfully completed.

Final innovations on the fifth Mirage IIIA are a revised windscreen incorporating a flat central panel, and the large black radome of the C.S.F. Cyrano fire-control. Retained as standard are the clamshell canopy, Hispano-built Martin-Baker lightweight ejection seat, and lateral engine intakes with automatically regulated shock cones.

An idea of the size of a Mirage was forcefully provided at Paris by the first IIIB two-seat trainer/combat aircraft, which was comfortably accommodated on the Dassault stand within the exhibition hall itself. The company pointed out that it could be built on the same production line as the IIIA and that, although intended as a trainer, it could rapidly be fitted for operational flying.

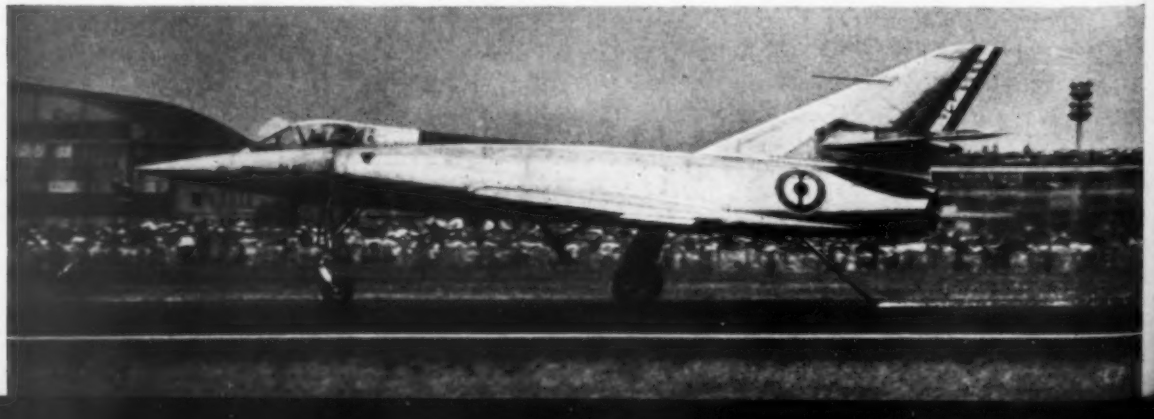
Mirage structure in general conforms to a style which appears to have been liberally inspired by American technique. But so tight is the fit that the two main fuselage frames which pick up the two wing-spars actually form the external skin and are thus clearly visible. One of them is machined from a single forging, as are all four spars. The nosewheel doors of the IIIB at the show were single, chemically-etched panels; and the perforated air-brake surfaces which extended above and below each wing, close to the root, also appeared to be single machined or etched pieces. A single long clamshell canopy covers both cockpits, and a further thick glass windshield will protect the rear pilot from wind-blast after the canopy is jettisoned.

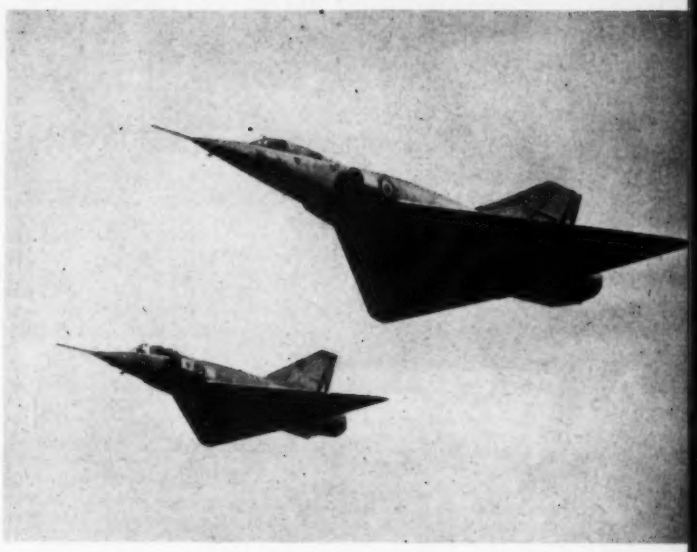
The cockpit layout suggests that space here is at a premium. Although full instrumentation is provided for both pilots, liberal use is made of miniature dials and what might be termed subminiature indicators and controls. The two main globe-type, combined artificial horizons and direction indicators are evidently operated from one of the new French central gyro references. Each pilot has a stand-by drum-type horizon instrument on his panel. Mach number and A.S.I. readings are combined on one dial, but space has been found for an A.D.F. indicator.

Two intakes immediately aft of the small gunnery radar in the nose lead to two sizeable heat exchangers. Manufactured by Messier, the main undercarriage legs are arranged to swivel as they retract, so that the main wheels with their distinctively ribbed Kléber Colombes tyres would lie horizontally in their compartments in the under-fuselage.

The fifth Mirage IIIA, mentioned above, is the first example of what might be termed the new Mirage III. The addition of the SNECMA Atar 9 and aerodynamic modifications have made possible an increase in the maximum Mach number to 2.3. Already an early Mirage has reached M2.1 with its Nord missile attached. At low altitude it has out-turned a Super Mystère, and it can carry a full range of weapons or tanks on under-wing pylons. The Swiss Air Force has recently examined a number of new intercepters, and it was reported at Paris that the Mirage was the most favourably regarded, with the Grumman Super Tiger and Saab Draken second and third. The Fiat G.91 has also, of

Exceptional low-speed handling qualities and the ability to operate from small carriers distinguish the swept-wing Etendard IVM seen below scraping its hook on the runway. On the right is the racy Communauté attack/liaison/training machine powered by two Turboméca Bastans. Its port spoiler is slightly raised. Far right, a Farnham automatic spar miller is typical of the elaborate production equipment employed





The Mirage IV supersonic bomber at its first public appearance. Powered by two SNECMA Atars, this aircraft has already reached M1.9. Escorting it is one of the pre-production Mirage IIIAs

course, been in Switzerland of late. But it seems that the Swiss are at the moment window-shopping, and that there has been no formal competition such as there was when the Hunter was chosen.

A major factor of the Mirage III is its ability to operate from short, semi-prepared strips. Its SEPR rocket motor is intended to increase acceleration at high altitude and not to raise the ceiling. For operations at low level, the rocket pack is replaced by a fuel tank. The standard air-to-air missile for the Mirage III is the command-guided Nord 5103, which can be used for forward collision-course attacks. The new Matra R.513 is apparently intended rather for pursuit attacks.

A notable development is the "weapons system" equipment for the Mirage III, which was exhibited for the first time during the Paris Show. One item was a flight simulator in a mobile van, produced by L.M.T. in conjunction with Dorand. More important is the collision-course computer and fighter-direction system produced specially for the Mirage by SINTRA. The system is designed to take information from standard early-warning radar and to produce on a radar-tube face continuous plan-position traces of aircraft movements. The presentation is housed in a transportable container produced by Aérazur.

With a two-speed joystick control, the operator can move a symbol over the trace of an identified hostile target, track it for a while, press a button and feed the target vector into the computer. Height information is added, and the computer (and symbol) will thereafter automatically track the target regardless of changes of heading. Target course, height and speed are then continuously presented on illuminated dials next to the scope. Having thus acquired the target, the operator will choose one of a number of bases whose geographical position is permanently available on the tube-face. He will choose it according to the time available for interception and the total climb gradient required between the take-off point and the first possible point of interception. As soon as the airfield has been selected by pressing a switch, the climb gradient, time required and distance to interception are registered on a further group of dials. As soon as the fighter is airborne and its echo registers on the screen, a tracking symbol is steered over it by the operator and its vector fed to the computer, just as was that of the target. Once again the relevant quantitative information is displayed on a third group of dials next to the scope. Finally the computer calculates from the two vectors the place and time of the first possible interception, allowing a direct run-in for a collision-course attack from any quarter and from below if necessary.

The lock-follow system is provided with an "electronic window" to hold the symbol over the echo even during evasive action. It is foreseen that the G.C.I. instruction to the fighter will be transmitted by data link to the pilot—not directly to an autopilot. At the correct moment, the Mirage's Cyrano fire-control radar is locked-on to the target under direct control from the ground. The Nord missile is automatically fired and its flight is guided directly by the Cyrano radar. The pilot is therefore simply flying the aircraft according to voice or instrument instructions, and is relieved of most of the work of computing the attack and launching the missile.

As shown at Paris, the SINTRA computer was contained in half a dozen or so standard, floor-mounted cabinets, and these were sufficient to control one interception. The system was shown working with the aid of a simulator. To increase the capacity to ten simultaneous interceptions, said company representatives, it was only necessary to multiply the numbers of cabinets by four.

It was also stated that, in calculating the correct airfield from which to originate an interception, the Mirage's 5 deg total angle of climb had to be taken into account. The endurance for a single interception at 60,000ft was given as 19 minutes, 13 of them for climb and combat and six for return to base. The recovery of the fighter was in fact controlled from the ground in much the same way as the interception itself.

Dassault themselves later elaborated on this very short interception endurance. The Mirage III could reach 60,000ft in six minutes, accelerating from M0.9 to M1.4 at 36,000ft, and reaching 60,000ft at M1.8. Five minutes were allowed for pursuit and attack, leaving ten or 12 minutes for a return to base. An interception, presumably including the use of the rocket motor, represented an extreme case, and the Mirage III could in fact achieve a ferrying endurance of 2 hr 10 min with an allowance for two G.C.A. approaches before landing. It was confirmed that the Mirage was flown all the time by the pilot, that its A.I. radar was controlled from the ground, that the missile was automatically launched, guided by the aircraft's radar, and that it carried a proximity fuse.

Dassault have been working for some years on fire-control radar, the Antigone and Aida having been exhibited at the Paris show two years ago. After these, the Super Aida, first known as the Asmodée, was prepared, but was abandoned in favour of the Cyrano produced by C.S.F. Aida now remains as the main fire control for the Etendard IVM, but Dassault have pointed out that Aida is attached to the nose of the aircraft by four quick-release fastenings and can be removed in four minutes and replaced by a variety of other fire-control radars, and possibly by a camera nose.

Aida transmits on X-band with a peak power of 250 kW and has two hemispherical dielectric fairings, one above the other. The upper unit protects the transmitter aerial and the lower the receiver. The system is designed for air-to-air, air-to-ground and air-to-surface firing with guns, rockets, bombs and air-to-air and air-to-ground missiles. The difference between air-to-ground (*air-sol*) and air-to-surface (*air-surface*) was defined as one of penetrating power and weight of explosive charge carried by the weapon. The first is something in the nature of an armour-piercing type of weapon, and the second is more likely to be an ordinary explosive or anti-personnel weapon. Aida can provide automatic ranging information on ships and control the launching of unguided rockets at correct range. It can be used for

(*Concluded on page 90*)

B.E.A. versus Traffic Recession

STEERING CLEAR OF THE RED: CORPORATION'S REPORT FOR 1958-59

"The year was also marked by the despatch of a letter of intent to Fairey Aviation for six Rotodynes." This photograph of Lord Douglas of Kirtleside, the Corporation's chairman, was taken after a flight in the prototype last month

SIMPLY stated, the most significant feature of B.E.A.'s financial year in 1958-59 was the ability to make a profit. Although the net figure shrunk from over £1 million in 1957-58 to just under £¼ million, last year was a period when even the most streamlined and well endowed airlines were struggling to break-even.

Anybody looking at the Corporation's latest annual report must dig deep to find the reasons for the decline in profit. A superficial reading would leave the impression that the sharp fall in load-factor from 64 to 60 per cent was primarily to blame. Yet the fact is that average revenue rates rose so sharply—the overall rise was almost 5 per cent—that the drop in load-factor was virtually cancelled out.

Basic to the fall in profitability was a rise in unit costs of over 2 per cent from 41 to 42 pence per c.t.m. This was almost entirely due to under utilization of resources—particularly aircraft and station staff. This, in turn, reflected the unfortunate fact that traffic failed to come up to expectations.

Under-utilization of resources, then, is the main explanation of B.E.A.'s fall in profits. But how did the Corporation manage to avoid the losses that were being experienced generally on European services last year? The most significant item here is certainly the load-factor. Although a figure in the sixties is low by the Corporation's own standards. very few other operators consider it to be a sign of depression.

Of almost equal significance was near-completion of the process of switching to Viscounts on all important routes. This aircraft, which thrives on cheap fuel and requires relatively little maintenance, allowed the level of unit costs for fuel and maintenance —which account for almost one-third of total cost—to be reduced at a time when operators of less amenable types were throwing up their hands in horror at the overpowering advance of inflation.

The report refers to the financial effects of bad weather. Winter fogs alone are blamed for a reduction in profit of £250,000. No mention is made, however, of the fact that Easter happened to fall twice in the Corporation's year 1958-59. This windfall must have more than compensated for the inclemencies of the weather.

As usual, the latest report is impeccably presented. Although a few other airlines are rather better at fashioning their main items of interest into a more æsthetically satisfying form, there is no doubt that no other operator even approaches B.E.A. in giving outsiders a glimpse of the inside workings of an airline. To appreciate the B.E.A. report one has only to compare it with that produced by the sister Corporation.

The layout conforms to that established in recent years. The review of the year is followed by a financial commentary which describes how traffic revenue rose from £27.4m to £30.6m while total revenue rose from £28.3m to £31.8m. Operating costs rose even more sharply from £26.5m to £30.3m. As a result the operating profit fell from £1.9m to £1.4m. After charging interest on capital—£1.1m as against £.8m the previous year—the net profit was reduced from £1,054,807 to £232,695. Over the period the total capital locked up in the organization increased from £34m to £40m.

The report goes on to discuss traffic trends. B.E.A.'s international traffic increased by 9 per cent over the whole year, but the pace quickened sharply in the later months as the recession began to recede. This improvement would never have been experienced had it not been for the Corporation's expansion in the Eastern Mediterranean and Middle East—a 25 per cent increase in traffic was reported for these routes, which now account for about one-quarter of total traffic. Brussels traffic was also up, thanks to the Exhibition. Although traffic to Eastern Europe was up by 669 per cent, the amounts involved were still not substantial. The international route which showed up worst was that to Paris, on which traffic fell by 11 per cent, allegedly because of "material diversion of traffic by services operated by British independent airlines." But the growth of surface traffic on this route suggests that a more fundamental reason was the recession, which led more people to seek out the cheaper forms of travel.

Where the recession showed up most was in the domestic routes: here the overall level of passenger traffic sagged by one per cent. The Channel Isles and the Isle of Man were particularly hard hit, and although the cheap week-end fares to Scotland and Northern Ireland were very well received they could not offset the summer losses on internal holiday routes.

With passenger traffic in the doldrums, B.E.A. pulled out all the stops on the freight front. As a result the volume of traffic went up by a sixth. Mail traffic also rose, particularly on services to Cyprus and Libya.

Looking at traffic generally, a noticeable feature was the restored increase in the number of first-class passengers. Another feature was the continued growth in inter-line sales, which now represent almost 25 per cent of B.E.A.'s total revenue. (Particularly important were North American sales, which last year amounted to over $4m.) Travel agents continued to sell 67 per cent of international passenger tickets, but their share of domestic passengers fell from about 41 to 35 per cent. Inclusive-tour traffic sold in the U.K. fell by 10 per cent; to recover their position in this growing field the Corporation went to war in I.A.T.A. and managed to obtain authority to reduce the fares quoted to tour organizers, particularly on mid-week and night services.

In a chapter on "Relations With Other Operators" the report makes a spirited defence of I.A.T.A. and an equally spirited attack on the independents. The Corporation's guns are turned in full strength on the "closed group" inclusive tours operated by the latter. Pooling agreements are applauded as "a means to achieve lower fares, not a monopolistic device to prevent them." Wider forms of association such as Air Union are also viewed favourably, although the hope is expressed that this "will not lead to an exclusive grouping in Europe which is antagonistic to wider regional schemes for air transport co-operation and co-ordination."

Coming to operational matters, the report emphasizes the withdrawal of the Elizabethan fleet and the placing in operation of the mixed-class Viscount 806s. Utilization rates—calculated on the basis of the effective operational fleet—showed a slight rise. Related to the total fleet, however, the rates fell; hence the increased incidence of obsolescence charges. Station "throughput" fell sharply in consequence of traffic failing to come up to the budgeted level. Crew utilization rates also fell, the average number of flying hours for each captain dropping from the low figure of 613 hours to a remarkably low 564 hours. Other cockpit crew only just managed to average over 500 hours each. During the year the number of pilots remained at close on 760, but the ranks of the radio officers were diminished from 142 to 128. This saving, together with a reduction in the proportion of non-revenue flying, prevented the fall in crew utilization from leading to a rise in the crew element in unit costs.

On the engineering side the Viscount check cycle continued to improve and by the end of the year had reached 145. 760, 1,520 and 3,000 hours for Checks 1, 2, 3 and 4 respectively. Overhaul lives for the Dart 506 and 510 were well above the 2,000-hour mark, while that for the Dart 520 installed in the Viscount 806s was already up to 1,400 hours. As a result of these changes the total number of checks actually fell last year. Nevertheless, the direct engineering man-hours per flying hour for each type tended to increase. This was because of the growing volume both of modifications (particularly to the Viscount 701s) and of work done by B.E.A. rather than by sub-contractors such as Rolls-Royce.

The final chapters deal with helicopters, personnel, medical services, organization and public relations. The Helicopter Experimental Unit managed to break-even for the first time by pushing the amount of commercial work—flying hours rose by 37 per cent. The year was also marked by the despatch of a letter of intent to Fairey Aviation for six Rotodynes.

Number of staff rose by 444 to 11,676, of whom all but 1,343 were based in the U.K. Turnover rates continued to improve and last year fell as low as 10 per cent. About half the staff have now been with the Corporation for at least five years, while one quarter —including all departmental heads—have served for at least ten years.

The concluding comment echoes the optimistic undertone that runs throughout the report: "The future is not without its problems, but with the human and material resources at our disposal we face it confidently."

J. C. S.

"Flight" photograph

Swifts and a Hunter at the Modification Unit, R.A.F. Laarbruch

ROYAL AIR FORCE GERMANY

Sustaining the NATO Shield

By HUMPHREY WYNN

TO the man-in-the-street in London or Llandudno, the concept of NATO is somewhat aloof and theoretical. It concerns him less than his overtime pay or that nice bit of stuff on the telly last night. To the Royal Air Force in Germany, however, the North Atlantic Treaty Organization is a part of daily life. The 2nd Allied Tactical Air Force, to whose resources the R.A.F. contributes a main part, depends directly (with the 4th A.T.A.F.) from Allied Air Forces Central Europe; and AAFCE in turn comes under the summit control of Supreme Headquarters Allied Powers Europe (SHAPE). There is therefore a regular consciousness of working with NATO as part of its defensive shield, intensified for the R.A.F. in Germany by being upon a foreign soil and operating with the Dutch, Belgian and German air forces. Further, there is the continuous presence of two masters, the Royal Air Force itself, and the 2nd Allied Tactical Air Force; and the Commander-in-Chief, Air Marshal Sir Humphrey Edwardes Jones, wears two hats as C-in-C. of both R.A.F. Germany and 2nd A.T.A.F.

It is slightly over two years since the Defence White Paper of 1957 reduced the size of the R.A.F.'s commitment in Germany by about half. By now, the dust of change has settled and the force has adjusted itself to its new pattern. It was therefore appropriate that the Air Ministry should have arranged a visit to Germany earlier this summer to meet the Commander-in-Chief and the Air Officer Commanding (A.V-M. W. J. Crisham), to see two typical operational stations (Gütersloh and Laarbruch) and to go to Berlin where the military and political problems are of a special kind. It was appropriate also that the tour should have ended at a Royal Netherlands Air Force and NATO airfield—Eindhoven—which was host from June 2 to 5 for the annual "Royal Flush" photographic reconnaissance competition between the 2nd and 4th Allied Tactical Air Forces. As recorded earlier, this event was won for the third successive year by 2nd A.T.A.F., with Swifts and Canberras of the R.A.F. contributing largely to the team's victory.

The R.A.F. has its headquarters in Germany at the vast military township in the Rheindahlen Forest, five miles west of München-Gladbach, where it shares administrative premises with the Army and the Royal Navy. In this joint headquarters, flying the flags of the Allied nations, there is a constant physical reminder of NATO associations. R.A.F. units in Germany form the biggest and most variegated Command in the Service, facing special problems. Some of these, like being based overseas, it shares in common with the Middle East and Far East Air Forces. Like F.E.A.F., it has the overtones of a supra-national organization affecting its daily tasks, SEATO being the Far East equivalent of NATO. But no other Command works so closely with the air forces of Allied nations.

During the period since the Defence White Paper of 1957 the R.A.F. in Germany has consolidated its resources and become still more closely linked with its fellow-components of 2nd A.T.A.F., the Dutch, Belgian and German Air Forces. The cuts made two years ago were severe; but the loss of Hunter day-fighter squadrons (where the heaviest reductions were made) has been somewhat counterbalanced by giving the Canberra light-bomber units a nuclear capability. The TSR.2 tactical-support aircraft is scheduled to reach the Command by 1965; and meanwhile the numerical strength of 2nd A.T.A.F. is gradually being increased as the re-constituted German Air Force slowly grows in strength.

In giving this report at a briefing which inaugurated the Press visit to Germany, Air Marshal Sir Humphrey Edwardes Jones said he expected to see his Command playing a big part for many years. At present, he commented, the enemy (using that term in a figurative and colloquial sense) had not got anything which could not be handled by what we have; and this reasoned optimism was underlined by the A.O.C., A.V-M. W. J. Crisham, when he described the R.A.F. forces in Germany as "lively; vital; well-trained and well-equipped; capable of giving a good account of themselves."

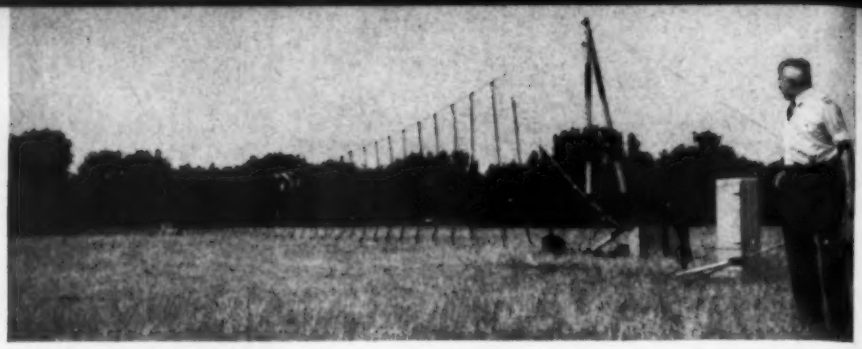
Sir Humphrey outlined the present dual position of the R.A.F. in Germany as part of 2nd A.T.A.F. and also as a separate entity. Its operational links with the Army and with the other European air forces are close. Allied Air Forces Central Europe depends from SHAPE, and from AAFCE depend 4th and 2nd A.T.A.F. with their assigned air forces. Between 2nd A.T.A.F. and the Northern Army Group there is a Joint Command Operational Centre; and this in turn has an offensive operational centre (with tactical operational centres at Goch and Sundern) and an air defence operational centre (with sector operational centres at Uedem and Brockzetel). The C-in-C. stressed that in this complex organization everything depended upon the maintenance of communications. To ensure this, there are cross-lines between centres to supplement the direct lines; so that even if the J.C.O.C. itself were knocked out the vital channels of communication could still be kept open.

The Commander-in-Chief said that when the White Paper reduced the R.A.F. in Germany by half it was expected that the German Air Force would build up speedily and so help to supplement the decline in Allied air strength in the northern NATO zone. But the expected build-up of the German Air Force had not occurred; and he suggested several reasons for this. One was that the West German Federal Government at Bonn did not possess quite the full powers and prestige of a normal national government; another was the availability of suitable airfields from which the G.A.F. could operate; and a third, the difficulty it was encountering in finding junior officers of suitable experience. The first German fighter squadron, equipped with Sabres, is now operating from Ahlhorn (an airfield occupied by the R.A.F. until last year). There are two G.A.F. fighter-bomber squadrons at Norvenich; it has an operational training unit at Oldenburg; and its other bases are Fassberg, Celle and Wunstorf.

In giving a detailed summing-up of R.A.F. resources in Germany today, A.V-M. Crisham said that the forces deployed were capable of going to war now, at the drop of a hat; though how long they could go on for was another matter.

He added as a corollary that it was a national responsibility to see that these forces were fully equipped and trained; and in giving a picture of the new deployment since the 1957 White Paper he said that when the cuts were made the R.A.F. units were moved back westwards and concentrated in the Rhine area. At the four "clutch" airfields near the Dutch and Belgian borders—Laarbruch, Brüggen, Wildenrath and Geilenkirchen—are the light-bomber, medium-range P.R. and all-weather fighter squadrons. The day-

Typical of photographic duties by No. 79 Sqn.: an "oblique" of Münster, taken from a Swift by F/O. R. E. Chitty



"Flight" photographs

(Above) One of the two nylon crash-barriers installed at either end of the Gütersloh runway. They can be raised or lowered in a matter of seconds. (Left) A Swift pilot of No. 79 Sqn. prepares for a sortie

ROYAL AIR FORCE GERMANY . . .

fighter and fighter-reconnaissance squadrons are further east, at Jever and Gütersloh.

The original Tactical Air Force which went into Germany in support of Allied forces during the liberation of Europe was a mobile unit; and the present one could be "put on wheels." The A.O.C. said there was no lack of transport—almost without exception, German; and with its own support units, the Royal Air Force in Germany was logistically self-contained. He summed-up its prime function as that of "responsibility for the frontier area"; and he added bluntly that it had a reputation to maintain for commonsense, horse-sense and effectiveness.

A.V-M. Crisham commented that in the opinion of R.A.F. authorities in Germany the standards of aircrew were higher than ever before. The only trouble was that they were not available in sufficient numbers. Those straight from training schools went to the Hunter day-fighter squadrons then graduated to Canberras or all-weather fighters, or even to the V-force, after their tour in Germany. The Canberra squadron crews were often constituted on a 50:50 basis of experience and inexperience; but the Swift fighter-reconnaissance pilots (with the accent on reconnaissance) had to be exceptionally experienced.

Such was the general picture of reasoned confidence presented by the Commander-in-Chief and the A.O.C. in assessing the present resources of R.A.F. Germany, with its Hunter, Canberra, Meteor and Javelin squadrons; its supporting maintenance units and Air Stores Park; its four Type 80 radar stations (at Breckendorf, Brockzetel, Uedem and Borgentreich), giving "quite enormous cover": a total of just under 13,000 personnel, whose general morale and efficiency seems to be on this report as high as in any Command at home or overseas.

Facing the 2nd and 4th Allied Tactical Air Forces across the Air Defence Interception Zone, the aerial no-man's-land between West and East Germany, are some 1,200 Communist-controlled aircraft deployed in E. Germany and Poland and Czechoslovakia. Behind them are the almost unlimited resources upon which the U.S.S.R. could draw if the cold war became hot. Thus the threat facing the Allied air forces in Europe is indeed formidable; and it was instructive in this context to go on from a briefing at R.A.F. headquarters in Germany to its most forward station, Gütersloh.

Lying between Münster and Bielefeld, this is a former Luftwaffe base and its officers' mess (in German days an aircrew mess) has a distinctive clock tower topped by a low-reaching tiled roof. Just below this is a small room used as a bar where, it is told, Goering used to spend social hours, and where he so often said "If I'm telling a lie may this building fall around my ears" that a beam across the ceiling was cut in two and a suitable lowering mechanism installed, so that on his next visit a part of the building did indeed fall upon the line-shooting field-marshal.

Gütersloh has three day-fighter (Hunter) and one fighter reconnaissance (Swift) squadrons and its "pair" as a D.F. and F.R. base is Jever, where there are two D.F. and one F.R. squadrons. A complex chain of command controls these stations, the Hunters coming under the Sector Operations Centre at Brockzetel, with its Type 80 radar and its even further-forward-looking radar "eye" at Breckendorf; and Swift activities being supervised by the Tactical Operations Centre at Goch. (There are two of these TOCs. No. 1 was formerly No. 83 Group and No. 2 formerly No. 2 Group. Each centre issues daily directives saying what tasks are to be undertaken). Neither SOC nor TOC has exclusive control at Gütersloh, for the station also comes under R.A.F. Germany.

The main rôle of the R.A.F.'s fighter force in Germany (five day and four all-weather squadrons) is that of investigating unauthenticated radar blips in the 30-mile-wide Air Defence Interception Zone which runs from the Baltic to the southern end of the 4th A.T.A.F. area. These may be caused by Russian aircraft which have strayed or Allied aircraft similarly overstepping friendly boundaries. To fulfil this rôle the Hunter squadrons are in turn on "battle flight" for a week. During this time there is a dawn-to-dusk standby, with a pair of aircraft at five-minute readiness. Or if need be, they can be brought to an even higher state of readiness by positioning on the O.R.P.s Another pair of Hunters is kept at 30-minute readiness and this pair is allowed to carry on flying normally until an emergency should arise. Information about what is going on in the ADIZ comes from the Type 80 radar at Brocksettel and its forward "eye" which sees even farther (the range of these stations is said to be between 250 and 300 miles). Gütersloh is the most easterly base of the NATO fighter forces and naturally in a sensitive position. Elaborate "fail-safe" precautions are taken to see that the Hunters' guns are not inadvertently fired in anger. In the night hours, defensive interception watch is maintained by the all-weather squadrons operating from further westwards.

The Hunter squadrons in Germany also have a low-level commitment in the ground-attack rôle. They go to Sylt twice a year for air firing practice, each detachment lasting five or six weeks and the aim being to give every pilot 15 live shoots. The squadrons compete with one another annually for the Duncan Trophy.

There are 16 or 17 pilots on No. 20 Sqn., one of the three Hunter units in No. 121 Wing at Gütersloh (the others are Nos. 14 and 26), and about half the aircrew are on their first operational tour. By contrast, their neighbours the Swift pilots of No. 79 Sqn. (one of the two fighter-reconnaissance squadrons, the other being No. 2 at Jever) are ex-instructors or on their second or third tour. Experience is very necessary for the exacting type of work they have to do, at high speed and low level.

The Swifts share with the P.R. Canberras six low-flying areas where they operate at 250ft and which are joined by "link routes" flown at 500ft (or, if conditions should be unsuitable, at 2,000ft). Owing to the limited endurance of their aircraft at such low altitudes the Swift pilots have to be extremely accurate in navigation as a journey of, say, 130 miles may allow them only five minutes over the target.

Tasks are specified by the appropriate Tactical Operations Centre (in the case of No. 79 Sqn., the one at Goch) and a typical one given to No. 79 recently was that of photographing 30 bridges on which the Army was practising demolition techniques. It wanted to know how effective were the methods of concealment used, and the squadron detailed five pilots for the job of supplying the required information. Working with it is a mobile field photographic centre whose speed in developing and printing the reconnaissance pictures plays an important part in successful P.R. operations. In low-altitude work, fewer negatives are needed to cover the target area. While the Canberra P.R. squadrons operate at both low and high altitudes the Swifts concentrate on the former, and it is the proud claim of pilots of Nos. 2 and 79 Squadrons that they know the areas of Germany over which they operate like the backs of their hands.

No. 79 Squadron had two pilots in the "Royal Flush" reconnaissance competition as members of the 2nd A.T.A.F. team, and the squadron is at present the proud holder of the Sassoon Trophy awarded annually for P.R. efficiency. No. 79's aircraft used to work in pairs, but now operate singly. At Gütersloh they and the Hunters have the comforting amenity of nylon crash barriers at either end of the runway, for use in the event of a landing made without brakes or flaps. Already this Swedish-designed device, which is raised in seconds by pressing a switch in the control tower on receipt of an emergency call, has paid for itself in saving aircraft and aircrew. Similar barriers are being installed at other NATO airfields in Germany.

Gütersloh typifies the day-fighter and fighter-reconnaissance side of the R.A.F. activities in Germany. The all-weather fighter squadrons (two of Javelins, two of Meteor N.F.11s, but being re-equipped with Javelins) and the medium-range P.R. and light-bomber squadrons (Canberras) are based at the four "clutch" airfields, of which Laarbruch is a fairly typical example.

(To be continued)

A ski-equipped DHC-2 Beaver for Wardair, an aggressive Quebec province air charter and air cargo operator

A BROAD REVIEW OF A FATEFUL YEAR

Canadian Aviation in 1959

By JOHN D. HARBRON

[*Toronto, August 18*]

THOUGH much of Canada's aircraft industry has received a 3- to 4-year reprieve as a result of the award of contracts for the construction of the Lockheed F-104G Starfighter for the R.C.A.F.'s overseas squadrons, the dark cloud that formed around the Dominion's aircraft makers following the termination of the Avro CF-105 Arrow programme last February has far from lifted. What the industry has been through since the cancellation of the all-important Avro Arrow programme, as well as critical assessments made by the Canadian community against the previously accepted high costs of air defence, have, in all probability, put a permanent damper on the expansion plans of military aviation in Canada on a scale anything like that of a few months ago.

As far as the aircraft and aero-engine fabricators and their expectant sub-contractors are concerned, the Lockheed contract represents the last major government order for a manned aircraft. Indeed, in many ways, the 1,400-m.p.h. F-104G is not a manned aircraft so much as it is a manned missile, whose armament must be nuclear in nature and whose mission must be as swift as that of a pure missile. But this is not so disturbing to the industry as the fact that the relatively known element of volume government orders to keep the industry alive is coming to an end and will not be conceivably replaced by anything of equal stature or volume in the pure missile era.

Internally, in the industry itself, the Lockheed contracts have produced squabbles of a type unknown before. The division of the prime contract between Toronto and Montreal was the cause of this. The Lockheed airframe contract goes to Canadair Ltd. in Montreal. The related aero-engine contract goes to Orenda Engines Ltd., A. V. Roe of Canada Ltd's engine subsidiary which almost went out of business when the Arrow contract suddenly terminated. But while the Canadian Government clearly states that it is determined to obtain "reasonable regional distribution of the industrial effort" across a large nation to build the 200 Starfighters, the machinists' unions representing the still inactive Avro Aircraft Co., A. V. Roe's airframe division, complained bitterly against "being left out in the cold" by the new Canadian Government contract. Thousands, left unemployed after the Arrow cancellation, have either gone home to Britain, to other jobs in the U.S.A., to non-aviation jobs in southern Ontario or are still looking for work. The great Avro aero-engineering team of Arrow days was not to be restored at the airframe division by the Canadian Government.

Of prime interest to both the nation and the industry is the end of the "cost plus" structure which had often brought aircraft makers in Canada as much as 7 per cent to 12 per cent on top of government contracts for aircraft manufacture, overhaul and repair. Canada's Defence Production Minister made it clear this week that the "gravy train era" was gone for good and is now replaced by a "target-incentive-price" basis. Neither Canadair Ltd. nor Orenda Engines Ltd. can spend more than the contract price and expect the Government to bail them out. The two companies, and presumably the numerous sub-contractors when they are announced, will get one dollar to every three of any money saved from the price bid. Any extra production costs over the bids will have to be absorbed by the manufacturer.

As far as most of the Canadian public was concerned, it was about time the aviation industry was placed on this basis. Since the demise of the costly Arrow, the Press, government representatives and members of Parliament have seriously questioned the way in which the money was poured into this fighter. "Avro costs [are] comparable with the Seaway" a leading Canadian newspaper stated over a year ago. Today, others ask if the $420 million to be spent on the complete Lockheed F-104G programme, which will pay for the manufacture of 200 aeroplanes, is even justified. (Incidentally, this amount approximates the figure given for the development phase leading to the construction of the first two Arrows alone!)

The huge amounts required to defend Canada in the air (and in the case of the Starfighters, which will replace the Sabre Mk 6 jets, in Canada's 12 overseas squadrons), perhaps are under more direct fire than was the CF-105 programme. When a Canadian air division was first sent to Western Europe under the NATO Treaties of 1949, countries such as West Germany, France and Belgium, undergoing industrial recovery from the' war, were defenceless in the air against the U.S.S.R. Today, all of them are not only prosperous, but two have been substantial customers for Canadian military aircraft. West Germany bought 225 Sabres from Canadair Ltd. Belgium bought a batch of CF-100s from A. V. Roe a few years ago. France is now a capable and volume builder of her own jet fighters. A growing number of Canadian critics, whose teeth were sharpened by the Arrow's end, ask why Canada must support these increasingly wealthy nations, now capable of building up their own air power? Perhaps a more effective tool against Soviet aggression in a changing age is to put defence money into larger aid donations to Commonwealth Colombo Plan nations in Asia, or make large grants to needy areas of Canada, where technological improvements are needed in a country just out of the worst recession since the 1930s. Add to this the mounting criticism of Canada's continuing air defence policy whose increasing reliance on American sources of supply give rise to concern about the nation's future independence as a military power, as well as the nagging criticism about the Mid-Canada detection line, which flared up in the country again this summer, and it is easy to understand why the move into the Lockheed F-104G's manufacture under licence has not necessarily brought universal relief in Canada or inside the aviation industry.

Yet in spite of the vast change from a year ago (when optimism still rested on the wings of the CF-105, supreme achievement of Canadian aviation skill) to today's ragged, uneasy pessimism, the Lockheed award sets the pace for Canada's military aviation outlook for the early 1960s. The award was announced August 15, after bids from the country's three major aircraft manufacturers,

Canadian Aviation in 1959 . . .

Geophysicists of Hunting Technical and Geophysical Exploration Services Ltd. pay out cable for the new Sparker underwater seismic device

A. V. Roe Canada Ltd, Malton, Ontario, De Havilland Aircraft of Canada Ltd., Downsview, Ontario, and Canadair Ltd., Montreal P.Q., had been reviewed. No comparative figures were released. The Canadian government merely announced that Canadair's had been the lowest. However to conform with government policy to spread the job over the country (and in Canadair's case to keep its 10,000 skilled workers in business after the CL-28 Argus and CL-44 programmes phase out), the prime contract was sliced down the middle for the Toronto and Montreal areas. Canadair Ltd. is awarded a 91,500,000-dollar contract to build 200 air frames for the F-104G. Along with this goes a bonus of 20 per cent of the West German order with Lockheed in the U.S.A. for 66 F-104Cs. The Canadian Government will buy 14 two-seater F-104 trainers in the U.S.A., as it would have been uneconomic to produce such a small number of a substantially different type in Canada.

Orenda Engines Ltd. of Malton, Ontario, will build under a $80 million order the engines for the aircraft, the entire programme to be completed about mid-1963. The J79 engine was created by the General Electric Co. and about 5 per cent of the total $420 million contract cost will go to Lockheed and General Electric in the U.S.A. in the form of licence and royalty fees. The rest of the contracts, for armament, electronic fire control systems, instrumentation spares and ground handling equipment, have not yet been awarded. The Canadian Government has assured the industry that the majority of these will be let in Canada. For those sub-contractors once committed to the Avro Arrow and now expectantly awaiting Lockheed business, the seven months' famine of no government orders will stretch out indefinitely. The Canadian government indicated that the profit estimate of the two companies would work out at about 5 per cent and that Orenda Engines Ltd. would be able to employ a total of 3,000 in 18 months' time when the contracts are in full production, and wind up in 1963.

The end of the Arrow last winter affected 11,000 employees of A. V. Roe Canada Ltd., Canada's largest skilled aviation workers' pool, who were all let out within hours of the announcement of termination. Many will go back to Orenda. But many will not. About 1,000 have returned to the United Kingdom over the summer. Another 1,000 have been wooed away to the U.S.A., and the rest are still in Canada, remaining unemployed or in other industries. A few had gone back to Avro Aircraft under a short term Canadian Government arrangement with Avro to maintain and pay a skilled pool of about 1,000 technical personnel, which expired on August 20 last.

Apart from the inevitable criticism over choosing a U.S. machine, reasons for final government choice of the Starfighter are easy to follow. First, it's the cheapest modern fighter on the market today, going for about $750,000 per unit compared with Republic's F-105 (which was the R.C.A.F's first choice), but which costs $3 million per unit. [The F-105 is a larger aircraft, with a higher attack potential.—Ed.] Nevertheless, the F-105 is the only one of a dozen types considered which was already in production. Actually, the so-called F-104G exists only on paper. It's the F-104C with Canadian adaptations everyone talks about.

Combustion chambers of a Rolls-Royce Dart under discussion in the company's School of Instruction in Montreal

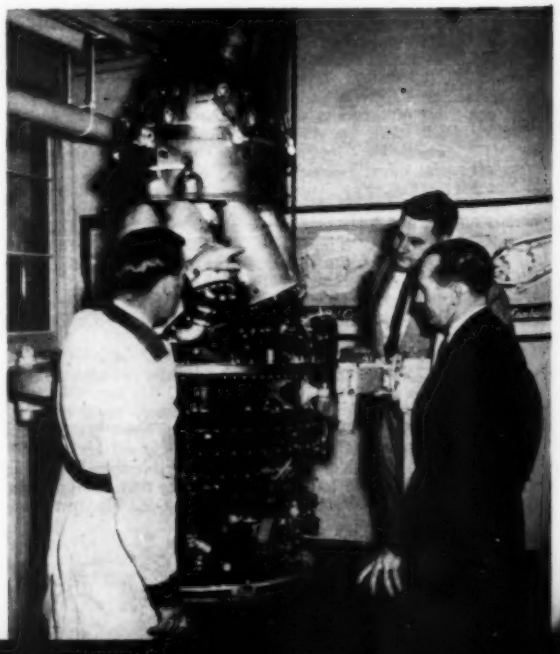
The Starfighter's first public appearance over Ottawa was a destructive one. It broke the sound barrier only once. But in doing so it caused $100,000 damage to Ottawa's spanking new air terminal, yet to be officially opened. The R.C.A.F. will officially designate the F-104G as the CF-111.

Though the Lockheed contract has brought back a good deal of life into Canada's most moribund heavy industry, the failure to announce sub-contractors near the date of the prime contract announcement still causes hardship among this diversified group in Canada. Some, such as Sperry Gyroscope of Canada Ltd., and Computing Devices of Canada Ltd. indicate that they are hopeful of a sub-contracting position, Sperry with instrumentation for the F-104G and Computing Devices of Canada with its original position and homing indicator. Other companies are naturally non-committal, though Dowty Equipment of Canada Ltd. which has made undercarriages for almost all commercial and military aircraft built in Canada since 1945, is hoping for the F-104G sub-contracting job as well. One problem for both the prime- and sub-contractors, is that a great deal of U.S. machinery will have to be imported to do the job, especially where Canadian companies have been working with British engines and British aircraft. Though Avro Aircraft Ltd. is not yet benefiting from the prime contract, it does have more adequate machinery, such as heavy-duty skin-milling machines left over from the Arrow's construction, which fabricate complete wings from aluminium slabs, which Canadair Ltd. apparently does not possess. Remembering the slight wings of the Arrow, an Avro official said this week, "We can build wings for the F-104G cheaper than anyone else in the country." Initial tooling for the airframe parts to be manufactured by Canadair Ltd. will, of course, come from Lockheed in the U.S.A.

Behind the final decisions for the prime contracts were certain considerations which automatically cut out some companies in Canada. Since it was agreed earlier in the year that Orenda Engines would have first try at quoting a price for manufacture of GE's J79 engine, this presumably left out such companies as Canadian Pratt and Whitney Aircraft Co. Ltd. when Orenda's bid was accepted. It would also eliminate from early consideration certain suppliers in Canada equipped, for example, to handle a Rolls-Royce engine but not American-made equipment.

Though the final working-out of both prime contracts and sub-contracts is not yet complete, the announcement of this replacement decision for the defunct Arrow business again roused interest in Canada's future air-defence picture. Inevitably, it has become tied in with the continuing health of Canadian nationalism. Among the more pragmatic and more crucial determinants of the NORAD structure the ever intangible, but ever-present aspect of Canadian independence in defence matters played a major rôle in its creation.

Certainly, whatever the Canadian Government's Department of National Defence does in the present interim period between the coming end of the manned aircraft era and the up-coming guided-missile phase, appears not only to be temporary, but in all instances, frustrating. This, of course, is because Canada, as a small military power, is neither large enough, nor is her populace willing enough, to assume a huge arms load. The announcement that Canada would take on the SAGE system (semi-automatic ground environment) along with the minimum of two Bomarc squadrons needed for it (to cover the southern Ontario and St. Lawrence Valley industrial complexes), not only pointed up this



dual rôle, but caused a new round of heart-rending about the future of the R.C.A.F. as an independent air force.

Before the Canadian Government had decided on a replacement for the manned Avro Arrow, it had decided on a nearly $200 million outlay for Bomarc and SAGE, the first post-Arrow move to tie Canada's air defence system's weapons to the U.S. defence structure. The dual concern now presented by the Lockheed purchase (apart from the criticism of equipping Canadian squadrons in foreign countries which can now look after themselves in the air), was on the one hand the next stage in American inter-co-operation, and on the other, much wonderment as to how the Canadian Government plans to replace the near-obsolete CF-100's in the country's 12 first-line squadrons at home.

This week, Mr. George Pearkes (Canada's World-War-One infantry hero, who dropped the title "general" when he became Conservative Minister of National Defence), was forced to announce that there would be (a) no more Bomarc sites than those already planned in Canada and (b) no ICBM bases in Canada, which, it was rumoured, had been requested by Mr. Neil McElroy, the U.S. Secretary of Defense. With the Canadian Mid-Canada, Pinetree, and soon the Lockheed intercepter itself tied into the SAGE system, whose planned bases in Northern Quebec and near North Bay, Ontario, would give further protection, Pearkes assured both worried Canadian nationalists and perhaps even more fretful American defence experts, that, for the time being, Canada would be well-protected. The only point he did not make and the one which concerns Canadians as much as increasing reliance on the Americans, was that Bomarc and SAGE will not be operational until about mid-1961 and the Lockheeds not until about mid-1963. What Canada does in the interval, is to rely, of course, on NORAD'S structure into which home-based Canadian squadrons with aging CF-100's are tied.

As if Pearkes', and indeed all Canada's, dilemmas were not enough, a searing attack against the inadequacy of Canada's Mid-Canada Line was made this month by the former R.C.A.F. officer in complete charge of the Canadian Air Force's radar activities in

Avian 2/180 Gyroplane, referred to on page 80

the late 1940's and early 1950's. With the blunt assurance that "I'm so mad I don't care if they hang me from the yardarm for saying this," retired G/C. Charles Limbrick said that he had always opposed the construction of an electronic warning line as a detection system only and indicated that Canadian scientists " . . . rammed it down our throats." The line cannot control today's operations of jet intercepters and anti-aircraft missiles as the Pinetree chain further south and the DEW (distant early-warning system), further north across Canada can do.

Limbrick had suggested a relatively inexpensive line (costing about $100 millions compared to the $250 millions it finally cost) which would have included eight control radars similar to the one at the R.C.A.F. air division headquarters at Metz, France, which controls the operations of the twelve squadrons in the division, scattered over four bases. Group Captain Limbrick's complaint was against the fact that no control radars, capable of directing intercepters or anti-aircraft missiles against incoming bombers had been built into the Mid-Canada system. The control function is handled by Pinetree, the most southerly of the three systems, which is further south and which, under present circumstances, operates too late to defend the nearby Canadian and American industrial complexes. In March of this year, the influential Canadian magazine *Saturday Night* published the most scathing attack to date of Mid-Canada Line's wasteful construction. Among other facts it indicated that the over-run on the Mid-Canada Line which it estimated to be, " . . . in the neighbourhood of $30 millions . . ." could "pay the total fees and maintenance costs of all four years for 5,000 young Canadians going through university" or, "buy 2,500 medium cost three-bedroom houses." In a two-part series, documented by letters, memos between government, air force and civilian contracting officials, the magazine told the story of the "Administrative Muddle of the Mid-Canada Line." For example, the cost of transportation and construction to

DHC-3 Otter of de Havilland making a water drop. This aircraft holds about 180 gal of water

get the equipment into the sites and to build homes for the men and for servicing equipment was $149 millions. The cost of the signal and radio gear was about $34,500,000. This means that transport and construction costs as opposed to equipment costs were in the ratio of 4 to 1.

The inability of Canada's government to come up with a firm defence policy, principally for reasons beyond the control of Ottawa Defence Department bureaucrats, such as the fast-changing pace of world rocketry and the increasing importance of Canada's independence of spirit, was best summed up in a still unconsummated promise made last summer by Mr. Pearkes himself: "Next year, we will have to start to get ready for this new era of defence."

Canada's Aircraft Companies

What, basically, has happened to Canada's three major aircraft manufacturers in the complex and unhappy shufflings since last year's report?

A. V. Roe Canada Ltd. The backwash of the Avro Arrow's demise of last February is still affecting Canada's largest single manufacturing empire. The resignation of Crawford Gordon, the company's president, was followed a few weeks later by the resignation of other senior executives. The resignations were placed at the decision by Avro's British parent Hawker Siddeley Group, and in particular by its chairman Sir Roy Dobson, to relieve the Canadian subsidiary of all senior executives who were no longer "persona grata" to the Canadian Prime Minister following the sudden shut-down of Avro's aircraft- and engine-making facilities last February by Mr. Crawford Gordon (within an hour of the decision by Canadian Prime Minister to terminate the Arrow contract). It had always been reported in the Canadian press that Diefenbaker and Gordon had never been the best of friends and Gordon's arbitrary action, which suddenly put 11,000 out of work, had worsened relations. And Sir Roy wanted a try at the Lockheed contract. Since the end of the Arrow, the following top executives of A. V. Roe's aircraft and aero-engine companies have resigned: the president of A. V. Roe Canada Ltd.; the executive vice president of A. V. Roe's aeronautical division; the president and general manager of Avro Aircraft Ltd. (an ex R.C.A.F. air vice marshal, always considered an Avro booster even before his resignation for criticizing government air defence policy); president of Orenda Engines Ltd.; vice president engineering, Avro Aircraft Ltd.; vice president, engineering, Orenda Engines Ltd.; vice president, sales, Orenda Engines Ltd.; and vice president, industrial relations, A. V. Roe Canada Ltd. Though Mr. Gordon's resignation was put down to "unresolved policy differences with the company" and the rest for reasons not yet revealed, Canada's Defence Production Minister indicated, after announcing the airframe contract to Canadair Ltd., that Gordon's resignation "hadn't made much difference" on his decision.

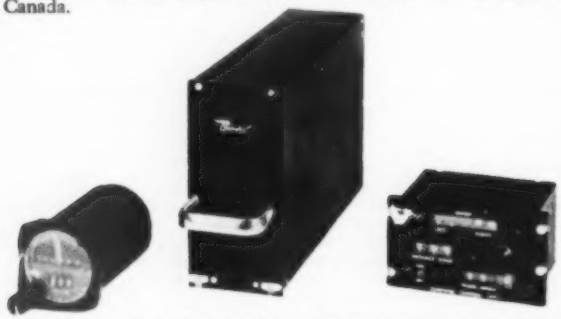
While Avro looks far removed from the relatively healthy positions of either Canadair Ltd. or De Havilland Aircraft of Canada Ltd., the company's non-aeronautical operations (which include Canada's largest bus and trailer manufacturing outlet and the country's third largest steel mill, Dominion Steel and Coal Co., also Canada's largest, single coal producer) are in much better shape. Considerable civilian business is coming to both Canadian Steel Improvement Ltd. (originally created to make titanium blades for the Orenda engine) and Orenda Engines Ltd., which reportedly has $15 millions in business ahead in adaptations of

Canadian Aviation in 1959 . . .

the Orenda engine to northern commercial needs in Canada and from sales of the allied Brush electrical group in Canada, which markets, distributes and services its products through Orenda Industrial Sales Ltd., a new subsidiary.

Both Orenda Engines Ltd. and Avro Aircraft Ltd. have considerable continuing repair and overhaul work on the CF-100, and Avro's famous "flying saucer" is scheduled to take to the air next month. The so-called Avrocar which employs a novel centrifugal system that "bends" a column of air to keep it aloft and move it faster, is under contract from the U.S. Army, which has put up the money for the experiments and final production.

An interesting off-shoot of Avro's still operative "flying saucer" activity, has been the formation of a new Canadian aircraft manufacturer to produce autogyros. Called Avian Industries Ltd. of Georgetown, Ontario, it was founded by Peter Payne, a senior test engineer of the "saucer" experiment and eleven other Avro engineers who were let out when the Arrow contract was cancelled. The first autogyro [page 79] is scheduled to fly in September and will cost about $10,000, or a third less than the most recent parallel U.S. autogyro. Already the company has received interested enquiries from the U.S.A. and, of course, Canada.



Computing Devices of Canada Ltd. Skyline Doppler computer, now being made under licence around the world (except in Canada) by Radio Division of Bendix Corporation

Canadair Ltd. is in better shape than any other Canadian aircraft or industry supplier at the present time. Even without the two Lockheed awards, Canadair, which is General Dynamics' Canadian aircraft and missile manufacturing subsidiary, is rejoicing in the sale of fifteen CL-44 turboprop freighters to the two largest all-cargo carriers in the U.S.A. As noted in column two, Flying Tiger Line have bought ten of these aircraft and Seaboard and Western Airlines five. Both have chosen the new CL-44D-4 version incorporating the swing-tail which, when opened, permits full-section loading of heavy freight into the rear fuselage. Powered by four 5,730 e.h.p. Rolls-Royce Tyne engines, these aircraft can carry a payload of 65,000 lb over a range of 3,150 statute miles, cruising at 392 m.p.h. These two commercial contracts are worth some $70m. In addition, the CL-44 line was started by an R.C.A.F. contract for eight of the military version, without the swing-tail, the first of which already has its engines hung.

Canadair are in production with a very attractive twin-Eland transport based on the Convair 440; also known as the Canadair 540 for commercial use, ten military models are being built for the R.C.A.F. under the designation CL-66. The company also have some way to go before production terminates on the big CL-28 Argus sub-hunter.

Canadair Ltd. has behind it a recent record of turning out 1,815 Sabres, from Mk 1 to VI, and for countries as widely diverse as West Germany, Colombia and the Union of South Africa. The company's later models, with the Orenda engine, were offered as better operational Sabres than those manufactured in the U.S.A. By the end of 1958, the T-33 Silver Star trainer manufacturing programme was phasing out, and by early this year, the last of the 656 T-33s. with the Rolls-Royce Nene engine, was rolled out. Other activities at Canadair Ltd. include development of the CL-41, an all-Canadian jet trainer for the R.C.A.F.; new production of Bomarc wings under licence from Boeing; and efforts to find a replacement for the manufacture of the Sparrow guided missile, cancelled for the latest CF-100 Mark. Canadair Ltd. now employs 10,000, about 20 per cent of Canada's aircraft manufacturing personnel before February, 1959. All of these will be retained under the new airframe arrangement with the Federal Government.

De Havilland Aircraft of Canada Ltd. On the surface, de Havilland seems to be in the happiest spot as far as steady orders on the books are concerned (that was so, at least, until Canadair Ltd. won the Lockheed contract). De Havilland's Beaver and Otter (Canada's famous STOL light cargo carriers) have now been sold to over 60 countries. The nature of their sales has become a by-word in Canada for an aircraft company which can "go it" without relying on government contracts. Yet all of de Havilland's outstanding government business terminates by the middle or end of 1960. This includes the end of the substantial Beaver sales to the U.S. Army and the delivery of the last Grumman CS2F-1 Tracker piston-powered anti-submarine aircraft to the Royal Canadian Navy.

As for the steadying civilian influence on sales of the STOL lines, it really isn't there at all in the sense that the layman thinks. Of 1,300 Beavers delivered between 1948 and July 31 last, 918 went to the U.S. Army alone, and the remainder to civilian world customers. The Otter sales picture is even more heavily weighted in favour of the large U.S. Army orders, which totalled 209 of the 300 Otters manufactured since 1952. The Caribou, launched in the fall of last year, has moved slowly as far as customers are concerned. Only firm orders so far are five for the U.S. Army, to be delivered early in the fall, and one on order for the Canadian Army, but not yet delivered.

Commercial Aviation in Canada

The varying fortunes and the sense of doom which pervade Canadian military aviation circles this year, have hopefully not extended to commercial aviation. Interesting new adaptations of old and new aeroplanes to meet imaginative terrain uses of aircraft in Canada's vast forest wildernesses; Trans-Canada Airlines' optimistic look to the 1960's; Canadian Pacific Air Lines' very efficient trans-continental flights, now operating from Montreal to Vancouver; and even the growth of a small used aircraft industry to match the booming American one, all indicate signs of fresh life in commercial aviation in Canada. Perhaps the biggest breakthrough of all in this field has been the sale of fifteen CL-44 turboprop freighters to Flying Tiger Line Inc. and Seaboard and Western Airlines. Seaboard has bought five and Flying Tiger 10.

A fillip to both the used-aircraft business and to prevention of the ever-present summer forest fire hazard in Canada, came this July from the formation of a new Canadian company devoted to water-bombing. The company is Forest Industries Flying Tankers Ltd. and it was created by six of British Columbia's largest paper companies confronted by some of the worst forest fires in Canada since the summer of 1950. The aircraft used are old World War II Martin flying boats, which are reportedly offered in Western Canada for about $250,000 each. Converted to "water bombers," the worthy old Martins now carry 7,000 gal of water each, and adequate spraying equipment. Both the Canadian Federal Government and all the provincial governments have traditionally always given a big boost to experimentation in aircraft designed or adapted to forest fire fighting. In 1947, de Havilland started on its world-wide Beaver selling programme following test operations and final sales of the first civilian Beavers to the Ontario Provincial Dept. of Lands and Forests. In the 1930's, the old Noorduyn Norseman was also adapted to forest fire prevention. Today, with about 400,000 acres already ruined by 1959's forest fires, Ontario's 40 odd radio-equipped Beavers maintain regular patrols over the vast forest preserves of Canada's largest province. The most recent announcement in this field is the use of schnorkel water intakes on aircraft operated by the Provincial Government of Manitoba. These intakes are attached in turn to the aircraft floats; thus making it possible for the machine to take on a water load as it taxis along the lake's surface.

One of the most prominent of Canada's small but growing helicopter operators is Okanagan Helicopters Ltd., along with one of its subsidiaries, Canadian Helicopters Ltd. These operate in British Columbia and the Yukon. In Eastern Canada, among others, are Spartan Air Services of Ottawa and Dominion Helicopters Ltd. at King, Ontario. All three, interestingly enough, have grown sufficiently in the last few years to offer helicopter training schools. Okanagan's is perhaps the most famous and now trains helicopter pilots for Canada's Department of Transport and even the U.S. Air Force. At present, in Canada, there are about 174 helicopters doing commercial work (omitting those operated by the Federal Government, the R.C.A.F. and the helicopter utility squadron of the R.C.N. at H.M.C.S. *Shearwater*, N.S.).

Equally important with the work of the helicopter companies in 1959 has been the quiet but continuing activities of the aerial survey companies in Canada. Basically unaffected by the tremendous changes of military aviation and by the influence on future civilian airline operations of such studies as the Wheatcroft Report, the aerial survey companies continue to work out long-term, detailed surveys and air analyses for private clients and the Canadian Government.

Hunting Associates Ltd. of Toronto are represented in Canada by the following firms of this British group: The Photographic Survey Corporation Ltd., Hunting Technical & Exploration Services Ltd., Hunting Airborne Geophysics Ltd., Kenting Aviation Ltd., Kenting Helicopters Ltd. and Field Aviation Co. Ltd.

Apart from topographic mapping and mosaics completed in

areas of Bolivia, Photographic Survey Corporation Ltd. in Canada was busy in early 1959 with major mapping projects leading to the realignment and improvement of existing arterial roadways by various Canadian provincial and municipal authorities. Flood-line mapping of 250 miles of rivers for the Metropolitan Toronto and Regional Conservation Authority, which has jurisdiction over 950 square miles, is under way. Serious flooding in the fall of 1954, a result of a tail-end twister from Hurricane Hazel, necessitated a ten-year flood control plan and the establishment of reservoir sites. P.S.C.'s topographic mapping will be used as a base from which high water marks are established for maximum flood conditions with resultant conservation planning.

Also this year, P.S.C. finally completed the colour proofing of 1,134 separate colour separation negatives for the manufacture of 21 full-colour maps of the geology, soils and landforms of Pakistan for a Colombo Plan survey.

The substantial oil magnetometer survey of the Mackenzie River in the North West Territories of Canada continues this year and will take a total of three seasons to complete. An area of about 25,000 square miles must be covered and members of both Hunting Airborne Geophysics Limited and Kenting Aviation Ltd. maintain a two-way radio system with ground stations already established at Inuvik and Tuktoyaktuk in the Arctic. The main base at Inuvik is in constant communication with the Toronto headquarters of the Hunting Group.

Underwater seismic work in the waters of Central Canada has also been undertaken during 1958-59. An instrument known as the sparker has been used by geophysicists of Hunting Technical and Exploration Services Ltd. in Lake Erie, Ontario, for submarine studies, chiefly related to foundation conditions for new docks and dams. The instrument made available to Hunting by Marine Geophysical Services Co. of Houston, Texas, is designed to map shallow geological horizons for application to foundation engineering. Elsewhere in the world, Hunting experts have supervised the use of this instrument in the Persian Gulf, for use in the English Channel tunnel and in the St. John River in New Brunswick.

Equipment Development

Though some of the major instrumentation companies in Canada, now rated as potential sub-contractors for the Lockheed, are eagerly waiting the volume business the Lockheed contracts can bring them, they are continuing with developmental work and the completion of apparatus for aircraft now under manufacture in Canada. Sperry Gyroscope Co. of Canada Ltd., for example, is completing the development model Stable Platform which is presently undergoing flight trials by the R.C.N. and de Havilland for the R.C.N.'s Tracker anti-submarine aircraft. Development work during 1958-59 reached a record high at Sperry and has included the following: the Models Control, a large radar training simulator; AN/FPS-35 antenna bearing instrumentation, a system measuring and recording some fifty parameters of a very large radar system antenna bearing; and automatic circuit tester, tape-controlled test equipment with a capacity of 2,400 test points for checking wiring and component values of complex electronic assemblies. Compass equipment and flight instrumentation were supplied during the year for several programmes.

Rolls-Royce of Canada Limited, though it will probably miss out on engine work for the Lockheed F-104G, unlike many other aviation supplier companies still awaiting Lockheed business, has plenty of work ahead from civilian aircraft commitments. These include the installation and servicing of the Tynes for the Vickers Vanguards for T.C.A., as well as in Canadair's CL-44s for the R.C.A.F., Seaboard and Western Airlines and Flying Tiger Line. Also following is the Conway jet which will see service with the Douglas DC-8s under construction for T.C.A. The plant at Montreal, which has long overhauled the Dart engine which powers T.C.A.'s fleet of Vickers Viscounts, is ready for similar duties for the Tyne engine when the above aircraft are ready for operation in Canada and the U.S.A.

This is the 50th anniversary year of the first heavier-than-air flight in Canada, by J. A. D. McCurdy. The anniversary was celebrated in February, and on June 15 Lt-Gen. E. C. Plow, Lieutenant-Governor of Nova Scotia, unveiled this memorial—a stylized stainless-steel model of McCurdy's Silver Dart—at Baddeck Bay, near the scene of the flight. In this picture are Mrs. G. G. Ross of the Canadian Aeronautical Institute, sponsors of the memorial, and Mr. J. K. Hawkshaw of Field Aviation, constructors of the model

Computing Devices of Canada Ltd., while awaiting possible word on Lockheed sub-contracts, will nevertheless supply its Mk 4 version of the position and homing indicator for the F-104s already purchased by the West German Government. As far as Canadian civilian business is concerned, a simplified version of the company's ANTAC (Air Navigation and Tactical Control) Universal Navigation System is in production for the transport version of Canadair's CL-28 Argus and the CL-44.

On January 1, 1959, Computing Devices took over operation of the four Canadian Decca chains from the Decca Navigator Company Ltd. and now operates them on behalf of the Department of Transport. The chains cover about a million square miles of Eastern Canada from Newfoundland to Montreal. Total personnel of C.D.C., including the Decca chain staff, now stands at about 650. Elsewhere, with world sales rights (except for Canada), the C.D.C. has developed the Skyline Doppler computer for transport aircraft. Acquired by the Radio Division of Bendix Aviation Corporation, the company is building an initial quantity of 50 sets. Bendix plans to team the Skyline computer with its own Doppler radar system.

The supreme irony of the year 1959 for Canada is that the 50th anniversary of the first flight made in Canada (and in the British Empire for that matter) was celebrated within weeks of the termination of the Avro Arrow contract. Within this short span, Canada had moved from the era of struts, nuts and bolts of which the Hon. J. A. D. McCurdy's *Silver Dart* in 1909 was mainly composed, to the Arrow, a warplane which needed 104,000 precision-fitting items to fly. In the midst of all this there remains the consoling factor that Canada's rugged terrain and demanding, harsh geography, which brought about the creation of de Havilland's all-Canadian STOL line of utilitarian aircraft, will continue to demand the best of Canadian aeroplane design, even if military aircraft become a thing of the past.

INDIA'S CONTRIBUTION

A DETAILED account of Indian aircraft production was given in *Flight* of December 19 last by a member of *Flight's* staff, following a tour of inspection. The company is styled Hindustan Aircraft (Private) Ltd., and its plant occupies over 1,100 acres. An extract from the report read: "Current activities at the South Indian factory are the manufacture of Vampires, both Mk 52 (Mk 5Bs) and T. Mk 55s (T11s), development work on the Pushpak and a new light aero engine, and overhaul of Canberras and Avons. In addition to this programme, the design department, under Dr. V. M. Ghatage, has been very active and designs have been produced for a 10-passenger high-wing transport, the HCP-25 "two-ton truck," an all-through jet trainer and an advanced fighter."

The Folland Gnat light fighter/strike aircraft (Bristol Siddeley Orpheus) has been adopted by the Indian Air Force and will be produced under licence by the company. Components and tooling are already being shipped to India. Hindustan Aircraft Ltd. also hold the licence for the manufacture of the Orpheus.

The HT-2 two-seat trainer, produced in considerable quantity at the same factory, is extensively used by the Indian Air Force and was favourably reported upon by our representative.

The Pushpak was described in these terms: ". . . the cockpit is kept as simple as possible. A fire extinguisher is fitted and the bench-seat is adjustable; radio can be fitted in the luggage compartment behind the seat, access to which is from the cockpit. Instruments (A.S.I., altimeter, compass, bubble slip-indicator, r.p.m., oil temperature and pressure) are of American origin, actually stockpiled instruments that have been adjusted and equipped with re-calibrated dials. Ailerons are of the Frise type and are differential in operation. Performance figures quoted were: maximum speed 115 m.p.h., cruising speed 86 m.p.h., and stalling speed 35 m.p.h."

CANADIAN AND PROUD OF IT

Advanced Canadian derivatives of the Bristol Britannia are the Canadair CL-28 Argus maritime reconnaissance aircraft (above) and the CL-44 long-range freight-liners seen "on the slips" in the large picture on the right. The Argus has four Wright Turbo Compound piston engines and the CL-44 has four Rolls-Royce Tyne turboprops. Piston engined, as is the Argus, the de Havilland DHC-4 Caribou STOL transport (below) has Pratt and Whitney R-2000s; whereas the Canadair 540 airliner (upper right) has Napier Eland turboprops.

CANADAIR CONVAIR 540
540

Sabre with Sidewinders: the first of a new batch should begin to leave the Commonwealth Aircraft line next December

Hope for the Australian Industry

By KENNETH GREEN

NOBODY looking at the record of the Australian aircraft industry during the past year can regard it as having been particularly rewarding. High technical competence has been shown, plus some initiative, and, as would be expected with the general growth of Australia's industrial structure, the ancillary industry particularly now offers a much stronger background should any emergency call for a concentration of aircraft industrial effort. But the main characteristic of the aircraft manufacturing section has been patience.

Most of the companies concerned have been waiting for the doubts, confusions and indecisions which resulted from the controversial British White Paper on Defence to settle down, in the realization that the rôle of the Royal Australian Air Force and the Royal Australian Navy in South East Asia demands advanced but not necessarily unconventional weapons. While they have been waiting orders have dwindled to a trickle, and staff cutting has left the industry with an almost irreducible nucleus. The weary waiting, particularly for Commonwealth Aircraft Corporation, has had its crumb of comfort only in the supplementary order for an additional 21 Avon-Sabres, and the policy declaration of the Government that the industry would be maintained as a supply background to the R.A.A.F.

The Avon-Sabre order was an earnest of that policy intention and a cause only for commercial satisfaction. The R.A.A.F. did not need them except as a stockpile against possible emergency; and it meant a costly revival of detail manufacture for a production line that was almost at an end. The first of the new line of Avon-Sabres will emerge about December; Rolls-Royce Avons are also made by C.A.C.

It has provided work, however, for skilled men whom the industry could not lose and yet hope to survive. And it has maintained a healthy Avon production line in the C.A.C. engine shops, though these, with orders for spares and overhaul work from the R.A.A.F.'s operational fighter and Canberra bomber squadrons, were better off than the aircraft factory. But the situation has not been enlivening for men who felt their efforts could be much more technically and economically productive.

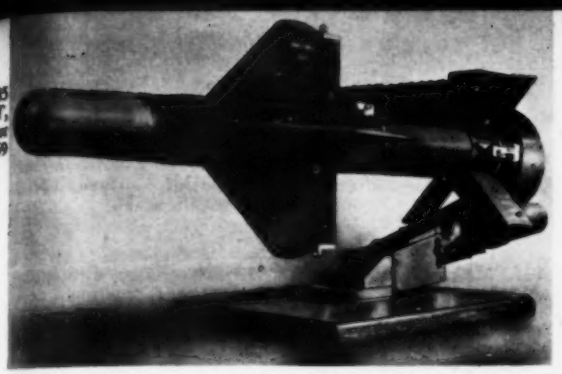
Now hope is alive again, though with a wry twist of humour. Four-and-a-half years ago a R.A.A.F. and Department of Supply re-equipment mission returned from overseas with a recommendation that, on the fighter side, the R.A.A.F. would benefit most from adoption of the Lockheed F-104. In all the circumstances of the time the Federal Government decided against it. "Too sophisticated" was how they described the then embryo Starfighter; there were other aircraft coming along that would more nearly meet the special needs of the R.A.A.F.

In the intervening period the equipment need has been kept under a sort of Micawberish review that showed periodic bursts of expectancy—but mostly, for the industry, a dull resignation. That period is now coming to an end and informed opinion is that about October-November the Government will announce its selection of a supersonic fighter for R.A.A.F. re-equipment—with the choice between the Northrop N-156F Freedom Fighter and the Lockheed F-104G. Despite the "too sophisticated" label given to it in 1955-56 the R.A.A.F. is believed to favour the Mach 2 Starfighter!

Other choices are to be made, too. Perhaps the North American Vigilante light bomber for one squadron; perhaps a new anti-submarine patrol bomber to replace the obsolete "long-nosed" Lincoln; perhaps a medium-range transport to supplement the Hercules. But only the fighter would be local production.

The recent decisions by the West German and Canadian Governments to put the F-104G into licence production for their NATO fighter squadrons, and the strong possibility that Japan will make a similar choice, offer an influence which, taken in conjunction with the proven performance of the Starfighter in U.S.A.F. service, the Australian Government will find hard to ignore. Northrop, however, are making a determined effort to win the R.A.A.F. decision for the fighter they designed and developed for the special needs of such countries as Australia. The R.A.N.

A contrasting type from C.A.C.'s Fishermen's Bend plant is the Ceres agricultural aircraft, developed from the Wirraway



The Malkara anti-tank missile (left) is a product of Government Aircraft Factories, as is the Mk 2A Jindivik target aircraft (right)

Hope for the Australian Industry . . .

has an eye on the N-156, also, for its light fleet carrier, H.M.A.S. *Melbourne*.

Australia's delay in making a decision on supersonic re-equipment has been attributed in part to the R.A.A.F.'s desire to make a flight evaluation of this comparatively simple but high performanced and versatile, short-field lightweight fighter. This month, less than a fortnight after the first flight of the N-156F in California a Northrop team has been in Australia to give the R.A.A.F. equipment planners the latest information resulting from the initial test flights. Headed by Northrop's senior vice-president, Mr. Robert Miller, the team included a weapons systems development engineer, a T-38 test pilot and an engineering representative of General Electric.

Lockheed, of course, are not standing idly by and in September they will have a strong technical team in the Commonwealth to advance the claims of their Starfighter. Both American firms are offering Australia export rights in the South Pacific and South East Asian area. There have been hints that some SEATO countries might be financially assisted by the U.S.A. to become customers, but if there is official backing for these hints it has not yet been announced publicly.

It is perhaps too easy, in looking at the present work-starved condition of C.A.C., to put the blame on indecision at Government level. The question must be asked whether this splendidly equipped factory, with its highly qualified engineering and technical staff, has shown as much initiative as it should in meeting the difficulties it has encountered, or whether it has not depended too much on hand-feeding from the Defence budget for its aviation support. Motor-bus body-building for General Motors, the building of fire tenders for the Department of Civil Aviation and the R.A.A.F., and some other commercial work, has filled some of the gap; but the only private-venture aircraft project carried past the initial design stage in the past few years has been the Ceres agricultural aircraft.

This one-ton capacity aeroplane—a well conceived and designed development of the war-time C.A.C. Wirraway trainer—has features that commend it as an excellent agricultural workhorse. It is simple to maintain and well backed with spares; has a good performance and flying characteristics and a work-consuming ability that gives it a high earning rate. In a demonstration last month in South Australia the Ceres maintained a superphosphate spreading rate of 15 tons (225 acres) an hour—a rate that kept three seven-ton trucks busy feeding it from the bulk supply base at the nearest railhead.

Two factors are militating against its success. The first is a rather timid initial production line for 20 aircraft, and a price based upon this of £A14,000 (£11,600 sterling). The other is the state of the immediate market, still suffering from the low prices for farm products last season. Only two Ceres have so far been sold—one in New South Wales and the other in Victoria—and a batch of three from the production line is still awaiting orders. C.A.C. are confident, however, that when the new season comes to its peak in December-January next there will be more orders from both Australian and New Zealand operators. Though the New Zealand market is reported at present to be "saturated" with new agricultural aircraft several prospective N.Z. buyers are being flown to Australia for Ceres demonstrations later this year.

There was a tentative move earlier—supported, it is believed, by the Director-General of Civil Aviation, Mr. D. G. Anderson—for C.A.C. to undertake the licence manufacture of either the Fokker F-27 or the Handley Page Dart-Herald for the domestic airlines and the Air Force. It did not get beyond the early investigation stage. The airlines were lukewarm and when Trans-Australia Airlines ordered direct from Fokker, with the Department following suit, the proposal was not pursued further. In the same period it is understood that Cessna offered C.A.C. the licence to produce their light aircraft for the Australian market. The terms of the offer are not known but C.A.C. did not accept.

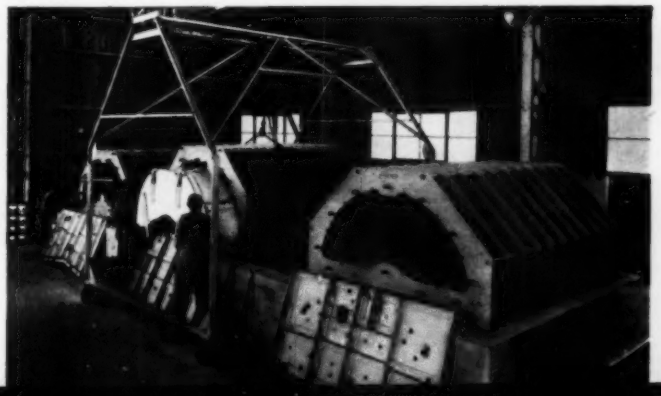
It is to be presumed there were good reasons for this rejection. But it is also worth noting that since November 1957 there have been 71 new Cessna aircraft—ranging from the 170B to the 310B—added to the Australian register, all imported from the United States. In addition there have been 33 Pipers, also imported.

It is to be noted, too, that it is only since the launching of the Ceres project that C.A.C. has set up a small sales department. The influence of this will be interesting to watch. Already it is known that the company is now more actively seeking commercial aviation work—overhauls, parts supply and design.

Among the Australian aircraft companies, de Havilland Aircraft Pty. Ltd., with their headquarters at Bankstown, N.S.W., has been noted for the emphasis it has placed on salesmanship and the resultant advantage it has gained. The main activities of this plant are still concentrated on the production of Mk 35 Vampire trainers for the R.A.A.F., and the modification and overhaul of R.A.A.F. Vampires and Royal Australian Navy Sea Venoms; but, with the end of the production programme in sight, D.H. is now seeking a contract for the production at Bankstown of Hunting Jet Provost basic trainers to replace C.A.C.-produced Winjeel basic trainers in R.A.A.F. schools. A Jet Provost, imported from England, has been loaned to the R.A.A.F. for six months' evaluation in straight-through jet training and D.H. hopes that a decision on local manufacture will be made as a result.

In the meantime D.H. is actively developing its commercial work. It has taken over the formerly C.A.C.-operated but Government-owned engine factory at Lidscombe, N.S.W., and is transferring there its propeller division and piston- and jet-engine overhaul departments. It claims that when this transfer is completed it will have there the largest and best-equipped servicing facilities outside the major Australian airlines. The company has for some years undertaken the specialist design and installation work needed for the "winterization" and special equipment fitment of R.A.A.F. Antarctic Flight (Australian National Antarctic Research Expedition) aircraft. Up to this stage Beavers have been mainly utilized on this work but at present D.H. has a contract to prepare and equip a Dakota and also overhaul a Beaver, both of which are to go south with the next expedition in early 1960. Civil sales activity previously concentrated on de Havilland and Hunting types has now been expanded by the securing of Australian and New Guinea distribution rights for the products of Beech Aircraft Corporation, U.S.A. A promotional campaign for these products is already under way.

The part being played by the Australian D.H. company (in conjunction with de Havilland Propellers) in guided-weapons development work at Salisbury, the South Australian head-



Left, servicing a Sperry Gyrosyn unit at National Instrument Co. Pty. Ltd. Right, pressure-testing Canberra tanks at Dunlop's Australian Aviation Division

The prototype Millicer Air Tourer Mk 1 (Continental A.65). This neat light aircraft is an all-Australian product that is arousing interest among private owners

Hope for the Australian Industry . . .

quarters of the Weapons Research Establishment, is security-blanketed, but it is obvious that this is an expanding and important section of the company's work. A recruiting campaign for engineering and technical staff for this branch has been in progress throughout the past year.

The biggest change-over of all during the year has been in the activities of the Government Aircraft Factories, which have their manufacturing base at Fishermen's Bend, Melbourne (adjoining C.A.C.), and an assembly, servicing, flight test unit and jet airfield at Avalon, near Geelong, Victoria—where, in recent months, Qantas Empire Airways has been carrying out its Boeing 707 pilot training programme.

Since it was first established during the Second World War as the Beaufort Division, Department of Aircraft Production, G.A.F. has been the bomber production source for the R.A.A.F., with the initial Beauforts being succeeded in turn by Beaufighters, Lincolns and finally Canberras. Canberra production has now ceased, and this section of the factory, with greatly reduced staff, is now engaged only in the design and incorporation of modifications to the Canberras. In its present programme, already well advanced, G.A.F. is incorporating in the Canberras integral wing fuel tanks, new radar and navigational aids, and an Australian-designed cockpit air-conditioning system.

There seems little likelihood that G.A.F. will get another bomber order, though it is expected that the supply of spares, repair and servicing activities for the Canberras will keep this line open for several years to come—and there may also be some sub-contracting work undertaken for any new C.A.C. fighter contract. With an engineering enterprise that is commendable (and results that equally merit credit) G.A.F. has, however, progressively switched into the new field of guided weapons, and the possibility of a world market.

Local design, development and production of Jindivik pilotless jet target aircraft and the Malkara guided anti-tank weapon now provide half the work-load of this factory and promise to provide even more. In consequence of these developments an excessively cautious security policy has been adopted which virtually blanks out this factory from any public survey of results. It is known from Ministerial speeches that orders for various marks of Jindivik now total at least 200, including an initial ten supplied to Sweden and 50 on order for United Kingdom guided missile ranges, but officially it is reported only that "substantial firm orders are held and further orders are expected in the near future, thus assuring continuity of production for at least the next three years."

The Jindivik Mk 2A (ASV.3 engined) with extended wing tips, pitot engine-air intake and redesigned rear fuselage, has successfully carried out trials at Woomera, to altitudes of 60,000ft, and there are later versions now on the assembly line which will incorporate ASV.8 and ASV.11 engines; this indicates a long line of development still ahead.

Malkara is, like the Short Seacat, a descendant of a basic design concept by the R.A.E., with a solid internal motor and a cruciform of moving wings. Wire guidance is obviously employed and the warhead is very large (50 to 60 lb). Following a visit of the British Minister of Supply to Australia last year a total of 150 Malkaras were bought for £320,000 (presumably Sterling), and at least 30 have been fired on the range at Kircudbright, Scotland. Their performance must have been very good, for last Sunday, August 23, it was announced by the British M.o.S. that the weapon had been adopted as standard by the British army.

It will be interesting, now that Britain has adopted Malkara, to see whether production orders are filled from Australia or, under licence, in the UK. In this connection it is worth noting, too, that the Australian Regular Army has not yet given the local factory the backing of an order, despite its initial trials of the anti-tank weapon with its varied uses.

The most interesting disclosure concerning G.A.F. activities was in the final paragraph of the report issued by the Department of Supply for this survey. It stated: "Design studies on other projects in the same field (Jindivik and Malkara) have been undertaken, and the factory looks forward to interesting developments in the future."

In what direction guided missile development will be carried by the Australian factory could at this stage be a subject for guesswork only, but it is obvious that the proximity of the Woomera range offers a facility that should greatly assist any project undertaken. Jindivik is already in constant use there, though the long life characteristics of this aircraft (as many as twenty flights) has reduced the potential order-book for early versions. A supersonic development is undoubtedly under development.

Both Jindivik and Malkara have provided sub-contractual work for the ancillary industry which has in consequence been given incentive to undertake progressive design and development. One of the most progressive of the companies concerned, National Instrument Co. Pty Ltd., an Ansett subsidiary, reported that it is producing Malkara guidance equipment "using printed circuitry and potting techniques." The same company is also producing the Mk 5 heightlock for the Jindivik, as well as low range, high range, rate of climb and air speed indicator transducers for telemetering purposes on the target weapon.

The Aviation Division of Dunlop Rubber Australia Ltd. is also said to be working on components for Malkara, though it does not include any mention of this activity in published statements. This factory, located at Bayswater, an outlying hilly suburb of Melbourne, and under the managership of Mr. E. F. Faggetter—a member of the C.A.C. wartime design team—produces a wide variety of flexible and pneumatic components for Jindivik. It has recently developed a power-operated braking system, incorporating Maxaret anti-skid units, for the target aircraft's launching trolley. This includes specially designed wheels and brakes produced by the Bayswater division. Another recent development for Jindivik from this firm is an electromatic valve to provide ultra-rapid lowering and raising of flaps.

It is interesting, too, to note that Bristol Aviation Services Pty. Ltd., a Bristol Aeroplane Co. (Australia) Pty. Ltd. subsidiary, located at Bankstown, N.S.W., now has a number of personnel in England undergoing training in the handling of the Bristol Sidderley Viper and has established turbine overhaul facilities for these engines which are used in Jindivik—but also, of course, in the Jet Provost.

Several projects in the light aircraft and agricultural field have been brought to prototype stage in recent years by various small companies in Australia, but most of them have not yet got beyond that stage because of Certificate of Airworthiness difficulties. The first breakthrough in this direction—and with a most promising future—is the Millicer Air Tourer, the original design of which won the 1953 Royal Aero Club design competition. This two-place, low-wing cabin aircraft, built over a period of years as a "backyard" project by Mr. Millicer and a team of enthusiasts, was granted its C. of A. this month.

It is a most attractive aircraft with several refinements not normally found in such a venture. It cruises at 100 kt, with an economy of three gallons an hour, is semi-aerobatic and handles in a way that has won the plaudits of a succession of hard-to-please pilots. It is to be put into production, first in a two-seat and later a four-seat version by a subsidiary company of East-West Airlines, Tamworth, N.S.W. There is a strong possibility that it will be adopted as a trainer by the Aero Club Federation of Australia. Mr. Millicer, a Polish-born Australian who served in the R.A.F., is Chief Aerodynamicist with the Government Aircraft Factories, but he has produced the Air Tourer as a spare-time effort.

Mr. Laurie Jones, of de Havilland Aircraft Pty. Ltd., arrives at Bankstown, N.S.W., with Maj. Peter Benjamin in a Beech Travel Air after an 18,500-mile delivery flight from the U.S.A. The D.H. company are Australian and New Guinea distributors for Beech

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

The Hovercraft's Curtain

FOR marine applications of the Saunders-Roe Hovercraft it would appear to be better to replace the curtain of air with water, thus containing the air cushion more effectively. This curtain could be under directional control for stability and propulsion, also allowing the cushion to escape in the direction required. No other propulsive device would seem necessary.

Why was the relative diagram in *Flight* for June 12 upside down?

Larkfield, Kent. D. FROUD.

[A water curtain was an idea proposed by Mr. C. S. Cockerell during the early development of hovercraft principles. He suggested that a marine craft should have two keels with a bubble of air pumped between them and contained fore and aft by a curtain of water. His reason for abandoning this idea is not known, but pumping only air seems to be the simpler solution.—Ed.]

The First Flying Meeting

AN important golden jubilee which should not go unsung is the first flying meeting, which opened at Rheims fifty years ago—on Sunday, August 22—and continued till the 29th.

Vast throngs flocked to the plain of Bethany and most of the famous pilots took part. Among those listed in the programme I see Blériot, Henri Farman, Latham, Robert Esnault-Pelterie (and his R.E.P. monoplane), Santos Dumont, Breguet, Paulhan, Sommer, Glenn Curtiss, and many more well-known then but now forgotten.

England was represented by George Cockburn, who owned the first Farman ever sold—known as the father of all Farmans. Cockburn was outflown by his more experienced French rivals.

Henri Farman flew round and round and round the pylons of the short closed circuit with wing-tips barely off the ground and won the Prix de la Champagne, covering 177 miles in 3 hr 4 min 56 sec. Latham. Paulhan and the Comte de Lambert flew respectively 154 miles, 131 miles, and 116 miles.

Glenn Curtiss won the Gordon Bennett Challenge Cup for the greatest speed in a closed circuit of 20 km at 43.35 m.p.h. He beat Britain in the person of George Cockburn, and France represented by Lefevre, Blériot, and Latham. During the meeting Blériot raised the speed record to 47.85 m.p.h.. and Latham in an Antoinette established the first height record of 155 m (508.5ft).

On October 18 of that same year the first flying meetings in England began. The Lancashire Aero Club got permission from the Aero Club (not yet Royal) to hold an international meeting at Blackpool. And then the Yorkshire Aero Club announced a meeting for the same week at Doncaster. The Aero Club outlawed the Yorkshire meeting, as it would clash with the other, and suspended the certificates of any pilots who competed at Doncaster. But the clash of these two meetings, and Hubert Latham's sensational flight in a gale at Blackpool (for which he was awarded the Aero Club's Gold Medal), is a story in itself. So don't let's forget that anniversary when it comes.

London, S.W.5. GEOFFREY DORMAN.

Helicopter Enterprise

I ENJOYED reading the article by John W. R. Taylor, entitled "The toy that grew up," in *Flight* for May 15, but was disappointed that the author made no reference to our company, a British concern formed in the Bahamas in early 1952. Prior to that we were a small American company, A-F Helicopters Inc., operating in Southern California.

We had the pleasure of being the first American operators of helicopters to do forest-fire work, flying on the Bryant Canyon fire during the summer of 1948 near Los Angeles. We also pioneered helicopter power line patrol, working for the Southern California Edison Co., and the Los Angeles Bureau of Power and Light, starting in 1948.

During the years between 1948 and 1952 the use of helicopters in industry grew rapidly in the United States, so it is difficult to know who may have been first in the various types of work. However, we enjoyed being among the first to use helicopters on most types of commercial work. In 1952, we became one of the first, if not *the* first, American companies to become interested in work outside our own country. At that time, when we became a British company, we pioneered the use of helicopters in oil exploration.

We also developed the technique of making heliports in the jungles of Netherlands New Guinea, so that the helicopters could play a major rôle in seismic exploration. We now have 18 Bell helicopters largely engaged in this type of work. We have also used them in desert areas, such as Egypt and Libya, principally in sand-dune country. I believe our group was the first to use helicopters in the Far North, as in 1952 we carried geologists, triangulation parties and scientists around Northern Greenland, landing as far as 100 miles out on the ice-cap at 8,000ft. It was our helicopters which placed the Brewster drill rig for the Shell Oil Co. in Netherlands New Guinea, using Westland S-55s, and the larger National 50 drill rig by S-58, in Papua, New Guinea. Our fleet includes, as well as the Bells, two Westland-Sikorsky S-55s, three Sikorsky S-58, three Catalinas, four Beavers, two Percival EP-9s, one Aero Commander and several light training planes.

Paris, 17e. Arni L. Sumalidason,
Executive Vice-President,
World Wide Helicopters Ltd.

[Indeed a fine pioneering record; but, as Mr. Taylor explained in a letter published on June 19, he had such a mass of material from all over the world that he was forced to cite only brief typical instances in the space available.—Ed.]

Freedom of the Private Owner

ISN'T it about time you sent your Cassandra—Roger Bacon—to stand in the corner? Take his first item in "Straight and Level" of your issue of June 12. Surely it doesn't take a superman to appreciate that annual movements for any transport system frequently bear no relationship to the traffic volume at peak times? If he doubts this, get him to dig out his prize presentation pewter pint pot out of the limbo (*annual* utilization virtually nil) and try squeezing a quart of beer into it.

Why not persuade him to READ the letters concerned, to do some work on the RELEVANT facts, to THINK and finally to make a SENSIBLE and FAIR comment. This we would welcome. It might help to set things right where they are wrong, and surely this is your aim?

Uxbridge, Middx. P. B. BLOW.

Roger Bacon replied (by post) as follows:—

LONDON AIRPORT has a peak traffic volume of about 600 movements per day. This is less than New York International, which has a peak of about 650. Yet at New York, private aircraft—providing only that they have radio—can land *without prior permission* any day, any time. The same applies at La Guardia—which is a busier airport than Idlewild—despite the fact that only 23 miles away is an airport (Teterboro) devoted exclusively to business aircraft.

Similarly, Chicago Midway Airport (the busiest in the world) has a peak of about 1,400 daily movements, a quarter of which are private aircraft. Possession of radio is the only prerequisite of acceptance. Again, though Chicago's peak traffic is more than twice that of London, private pilots don't have to write a letter for permission to land—they just join the circuit.

I think it fair to comment that, so far as private aircraft are concerned, London—and indeed British A.T.C. in general—is an efficient master (and no one challenges its efficiency) rather than an efficient servant.

There is a most impressive piece of evidence in *Hansard* to support my views about the discouraged state of British private flying. Asked in the Commons in June the numbers of civil aircraft licensed to carry not more than five people in 1938, 1948, and 1958, the Minister replied as follows: *1938:* 1,001; *1948:* 818; *1958:* 789.

The Minister gave these figures without comment. None is needed: they speak for themselves. ROGER BACON.

Mr. Blow now writes:—

"My concern was not about the particular problem under discussion. The subject, though of considerable importance, was purely accidental. I was concerned about the logic of the argument and the relevancy of the facts used in such an important argument. These I felt to be below your usual standards and to be unconvincing. Roger Bacon has now obviously taken great pains to dig out the facts relevant to this important problem and has put us in a position to make a fair judgment. This surely is what we should expect from a serious technical journal in all such problems."

IN BRIEF

Mr. John Pudney is writing a book about the Atcherley twins, and Air Marshal Sir Richard Atcherley has given him access to papers for this purpose. Mr. Pudney (whose address is Cherry Orchard, Fairwarp, Uckfield, Sussex) would also be grateful to hear from *Flight* readers who can offer anecdotes or other information.

Mr. Leslie A. Robertson is engaged on research into R.F.C., R.N.A.S. and R.A.F. aircraft markings in World War I and he would like to hear from any readers—particularly those who served at that period—who can provide information; he especially wishes to contact Capt. Sykes (201 Sqn.), W/C. Maxwell (56 Sqn.), "Taffy" Jones (74 Sqn.), and A. H. Curtiss (49 Sqn.) Mr. Robertson (whose address is 1 Cape Close, Lexden, Colchester, Essex) is also interested in "which pilots flew which aircraft."

Straight and Level

THE best article written about the Hovercraft to date was easily "A Revolution in Transport," published in *The Sunday Times*. It was by Mr. C. S. Cockerell, inventor of the Hovercraft.

Technically, the most significant extract was perhaps: "The basic theory behind the Hovercraft is that a heavy craft can be supported, near the ground, on a cushion of air that is produced by a thrust much less than the total weight of the craft." The author went on:—

"If I doubled the diameter of the craft I also needed to double the thrust of the containing air—but I could then quadruple the total area and the weight. From this it can be seen that one of the most important characteristics of the Hovercraft is that its efficiency—that is, the weight that can be lifted for each horse-power—increases with size."

* * *

Non-technically, an incidental sidelight on the author rather appealed to me:—

"In 1950 I ended 15 very happy years as an electronics engineer . . . and turned to boat building as a profession. My wife and children moved into a caravan, and I climbed into a pair of overalls and a completely different life. It was a very real pleasure finding at last that I was doing something that the non-technical world could understand. Building boats seems much more definite than inventing new sorts of 'black boxes' in the depths of the electronics industry."

● I can reveal that next week the closure of London Airport will be announced by Mr. Hugh Strangeways, Minister of Planes.

The reasons given will be (1) "Continued heavy expenditure on the airport is not, by and large, in the light of present circumstances, justified"; and (2) "The airport does not conveniently fit into the air traffic control pattern for Greater London."

The question of suitable alternative accommodation for operators will be "kept under active review."

● Few people in British aviation will have derived much pleasure from reading about the Boeing 707's troubles. Instead, a sort of sympathetic fellow-feeling goes out, untainted with patronage.

And I feel sure that allowances will be made for the exuberant, almost gleeful, headlining—reminiscent of early Comet and Britannia days—of even the most trivial 707 incidents (for example, the recent failure of a ground-power truck at New York). The pinnacle of fatuity was reached when a newspaper for quite Top People ran the headline, "B.O.A.C. NOT TO CANCEL BOEING 707s."

Yet I must confess, unwillingly, to some small satisfaction that the world is being made aware of the fact that troubles are not endemic to British aircraft.

● The Western Seaboard Chapter of the American Fall-out and Nose-cone Recovery Society held their fall meet yesterday. Convention section chairman Bluff Z. Body said, "Presently, as of now timewize, we are predicating our future mission program posture capability on the concept that what goes up must come down." He added:—

"All meetsters must acceptivate in a systemized promotion to unphase launchings of hardware into orbit."

The 84,776 members present voted to procure a 2,000,000-ton destruct magnet to de-orbitize existing satellites, while their Free World radio station ICBMX chanted "down to Earth, down to Earth, down to Earth . . ."

● Did you read H. R. Broadbent's article on jet noise in *Flight* for August 14? I have always felt that present-day scientific methods of noise measurement satisfy neither the scientist nor—and these are the people most affected—the general public.

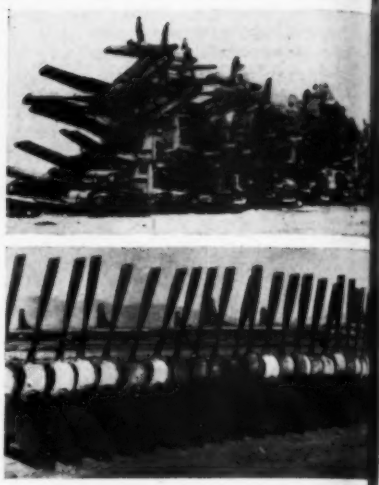
Mr. Broadbent proposes the use of the "noy," a unit which (referred to as "N") seems to offer, at last, a sensible measure of noise as opposed to sound. The crux of his thesis, I thought, was that while "perceived noise levels" for jet and propeller aircraft at a distance of 1,000ft range respectively from 121 to 107 (take-off power), the *noisiness* figures range from 274 to 104. In other words, the figures quoted by airport authorities to airport residents conceal the fact, acknowledged by most reasonable people, that in the vicinity of airports the jet can be twice as noisy as the piston airliner.

* * *

When, last October, the Port of New York Authority were laying down the law about noise to jet operators, it was pointed out by these operators that communities like Los Angeles had got used to jets and had accepted their noise. Now, I see, complaints from residents living east of Los Angeles International Airport have got to the point where they are threatening legal action "if something isn't done." Meanwhile, the authorities at New York are receiving "more complaints than we can handle."

CORRECTION

We are asked by Sir Charles Boost to point out that he did not, as reported, describe the Planes Minister as "an inferior Grade C sub-moron who needs a well-aimed kick in the teeth." His actual words were "an inferior Grade B sub-moron who needs a well-aimed kick in the teeth." We regret any misleading impression that this mis-quotation may have caused.



Aeroplanes come and aeroplanes are dumped, but defence goes on for ever. And, for the U.S. aircraft industry—whose military products dominate the power-politics of the entire world—business goes on for ever. But *will* it be for ever? Do these pictures of F-84Gs and B-36Js junked for the melting pot presage, as the political ice melts, junked Thors, Atlases and Titans? Then, I suppose, the only members of society who will feel grateful to the U.S. aircraft industry will be the scrap-metal merchants

● *"Infrared-seeking Firestone (sic) by de Havilland is carried by Hawker Hunter in this recently released photograph"*—So announces one of our most respected American contemporaries in the missile field.

As a matter of fact, this all-British rubber missile has long been the envy of the Americans; once fired, it homes unerringly on to its target and can pull quite tight turns without skidding, even in wet or icy conditions.

● You would have thought, wouldn't you, that an operator like Ethiopian Airlines might well be typical of the many national airline luxuries that small undeveloped nations can ill afford?

I am astonished to learn that little Ethiopian has shown a profit for five years running without a penny of government subsidy. This is not so much a credit to T.W.A., which manages Ethiopian, as to a government enlightened enough to have put its national airline in the hands of a big-league professional. I hope that Ghana Airways and Nigerian Airways, and others under B.O.A.C.'s tutelage, will in years to come enjoy a prosperity comparable with Ethiopian's.

● "And what do you expect to find when our American space boys reach the Moon, General?"

"Russians."

ROGER BACON

THE INDIAN AIR FORCE

W/C. K. N. Chawla, C.O. of the I.A.F. jet training wing at Hakimpet, Jodhpur, discusses with his technical officer the high-speed finish which has been re-applied on the station to some of the wing's Vampires

PART III

An Appraisal of a Commonwealth Air Arm

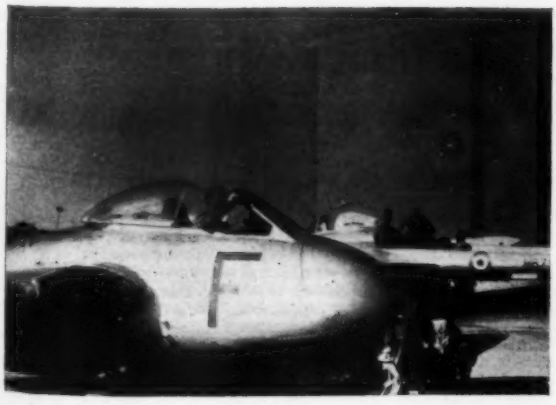
By ALASTAIR PUGH

AFTER training at Jodhpur pilots and navigators go 700 miles to Hyderabad for advanced training at the twin airfields bearing the Tweedledum and Tweedledee names of Begumpet and Hakimpet; the former is the home of the Transport Training Wing, the latter of the Jet Training Wing. Pilots are chosen for their course by inclination or by vacancy but more usually by aptitude. In command of the two Wings is G/C. R. Atmaram, who has his station H.Q. at Begumpet. This is also Hyderabad airport and it is shared by I.A.F. Dakotas and by DC-3s and Viscounts of Indian Airlines. The latter operate both scheduled services and training flights from the I.A.C. Central Training Establishment.

There is naturally some professional rivalry, particularly between the T.T.W. and I.A.C. instructors, but there are also interesting lessons to be learned from the different operating techniques that the two organizations adopt. The airline is primarily concerned with safety, the I.A.F. with operating at a calculated risk under extreme conditions ("I can tell you, there are pilots on the Naga operation who can put a bag down on a tennis-court-sized D.Z. at the bottom of the 8,900ft valley near Wallong and then turn around and hit it with all the other bags").

Instruction for both wings is deliberately intensive. The day begins at 0530 hr, and until lights-out at 2200 pupil pilots and navigators are kept occupied with an organized programme that includes ground and flying tuition, games and study periods. Each course is divided into "advanced" and "applied" stages, and a new intake starts a year's service at Hyderabad every January and June. Each stage of training occupies five months, giving a break of two months in July and August during the worst of the weather.

At the Transport Training Wing a few more hours—130 as against 120—are flown in the applied stage of training, as the advanced stage involves rather more emphasis on ground subjects prior to an end-of-stage examination and squadron commander's assessment. During the course (both stages are divided into "A" and "B" flights alternating daily between flying and academic study) pupils prepare a thesis on such subjects as "Radar in Modern Warfare" or "India's Second Five-year Plan." Over 90 hr of private study is officially devoted to this project, but the cadets' enthusiasm often results in a good number of precious free-time hours being absorbed as well.



The training day at Hakimpet begins at 0530, and daily inspections on the many Vampire T.55s and 52s have to be started equally early

Throughout the course the workshop training that is a feature of the daily routine of the operational squadrons continues, for it is considered important that a pilot is competent to D.I. his aircraft in the field.

General handling, instrument flying, night flying, longer cross-countries, 12-15 hr of monsoon flying and 12 hr of supply dropping are included in the applied stage of training and bring the cadet to Transport Command D category standard (a re-categorization test is taken on joining a squadron) with a white instrument rating, a total of 375 flying hr and—on passing out—his I.A.F. wings, which are pinned to his tunic at the passing-out ceremonial parades held alternately at the Transport Training Wing at Begumpet and Jet Training Wing at Hakimpet.

The officers' mess at Hyderabad, a 14-mile drive from Begumpet through the army lines, is old, lofty and gracious (it is reputed that Sir Winston Churchill stayed here during his service in India) and one of the pleasantest of many hospitable evenings was spent with officers from the Jet and Transport Training Wings on the lawn under the trees bright with lights for the forthcoming Diwali festival, and at dinner at the long refectory table, gleaming with reflections of the mess silver.

Next morning we visited the Hakimpet airfield to see the Jet Training Wing at work. Early as we were, the first detail was already returning to the flights under the bright light of the early morning sun, the scream of Goblin compressors rising to a concerted crescendo as the Vampire T.55s and 52s taxied down the ramp. They swung into place among a long line of parked aircraft that the bowsers were already starting to refuel. W/C. K. N. Chawla and his technical officer admitted that noise (which at the beginning and end of each 30 min turn-round was quite deafening) was something of a problem, as it interfered with the pre- and post-flight briefing accompanying each sortie; it had not been quite so bad when training was given on Spitfire 9s and 14s and Tempests, but that had been many years ago; the first Vampires were received in 1948 and the two-seaters in 1954.

The year's course, as at the T.T.W., is divided into advanced and applied stages, giving a total of 150 hours' jet flying. The first stage is devoted to Vampire conversion (dual and solo flying being about equally divided) and to ground instruction under a Chief Ground Instructor.

At the time of my visit six of the pilot-cadets on the course were foreign pilots under training and others naval pilots (distinctive in their crisp white tunics and shorts) who are trained with the I.A.F.

The applied section of the course is more or less permanently established under canvas on the far side of the apron, presenting a very operational atmosphere. The tents are organized in much the same way as the Flights, with a flight commander's office, map and chart-lined briefing room and instructors' and cadets' crew rooms. The instructors operate an all-through training scheme, and those on the applied course (battle tactics, night flying, live gunnery, QGH let-downs and white card I.F.) had already trained their cadets at the advanced stage.

After a quick tour of the hangar with W/C. Chawla to see some of the Wing's Vampires being serviced and to examine the high-speed finish which is being successfully re-applied by

Noise at the beginning and end of each sortie, when 20 or 30 machines come in to refuel, is something of a problem in the nearby pilots' briefing-rooms

THE INDIAN AIR FORCE . . .

techniques devised by the Wing (the Senior Technical Officer was a student at the de Havilland Aeronautical Technical School under W/C. Clapp and S/L. Reeve), it was time to leave for Delhi. This had been the starting point of the tour, and now brief meetings had been arranged for me with the Chief of the Air Staff, Air Marshal S. Mukerjee, the Director of Policy and Plans, A. Cdre. Dutt and the Director of Intelligence, G/C. R. Sitaram.

The office of the C.A.S., cool, map-lined, quiet but unpretentious, is in the rambling Air Headquarters building in Delhi, once occupied as a headquarters of the Army in India and now the I.A.F. equivalent of Air Ministry.

In the few minutes that I had with Air Marshal Mukerjee I sensed in the humour and gentleness of the senior officer of the Indian Air Force the stamp of India on the best that was left behind on the first day of India's independence. There is plenty of evidence of British institutional survival in India and, superficially at least, nowhere more than in the Indian Air Force. In tradition, in organization and in language the I.A.F. follows closely the established pattern of the Royal Air Force.

During my visit I had been welcomed everywhere with something of the warmth that is reserved for friends; and I believe that the lesson that Air Marshal Mukerjee and A. Cdre. Dutt hoped that I would learn from unfettered observation of every aspect of I.A.F. activity was that the association of the I.A.F. with the R.A.F. and with the British industry continues *because* of India's independence rather than in spite of it. Independence and democracy remain precious words in India, and so to many does the idea of the British Commonwealth.

A. Cdre. Dutt insisted that here was the first key to any understanding of India. The formation of a republic had not resulted in the complete severing of old ties, but it had changed India's relationship with Great Britain from one of reliance by necessity to association from the independence of free choice. The greatest danger that the Commonwealth faced, he emphasized, was not competition from the industrialization of India, but the threat of continued poverty and depression among her many millions of people.

As the air arm for defence of the stronghold of democracy in Asia the Indian Air Force carries its heavy responsibility by being a well armed, well-equipped and disciplined service. It is efficient and well trained. Technically it is now competent enough to undertake aircraft development on its own behalf and the skill of some of its pilots is already a byword. Its rôle is defensive, for in India's struggle for better living there is no place for aggression or political adventure. But should its freedom or independence be threatened it is equipped to retaliate—and to strike back hard and well.

SUBSONIC TO SUPERSONIC (Continued from page 73)

map-painting and can also illuminate targets for beam-riding missiles as well as serving for infra-red missile launching.

During the great air displays at the end of the Paris Show, Dassault aircraft were able to occupy a considerable portion of the programme. First the Communauté hummed quietly around demonstrating its ability to achieve a radius of turn at low level of about 200 yd; and it is claimed that it combines with this agility and short-field capability a range of 1,250 miles at a cruising speed of over 340 m.p.h. Next came two of the pre-production batch of Etendard IVMs, putting up a most convincing demonstration of manœuvrability at low speed. Three Mirages followed, one of them emitting a long tongue of brilliant orange flame from its SEPR rocket motor. After the Mirage IIIs, the Mirage IV made a single fly-past accompanied by a fourth Mirage III acting as "chase plane."

Putting the seal on Dassault's remarkable production history was the *Patrouille de France*, the French Air Force aerobatic team from the Dijon fighter wing, flying Mystère IVAs in a splendidly spectacular co-ordinated formation-aerobatic show. This 14-man team is incomparably better than the *Patrouille de France* of two years ago, and the French pilots' prowess really had the No. 111 Squadron team worried.

One of the Mirage IIIs performed the fastest rolls I have ever seen in my life. I used to think that the Sabre rolled very quickly. During this Paris air show the Saab Draken rolled much more quickly. But a few minutes later that Mirage did three or four rolls without stopping at a rate which must surely have approached the 360 deg per second. None of the long-bodied transatlantic supersonic fighters to which we have become accustomed could risk even attempting such a manœuvre. The Mirage seemed to take it in its stride, although I cannot imagine how the pilot managed to stop rolling with his wings level, as he did.

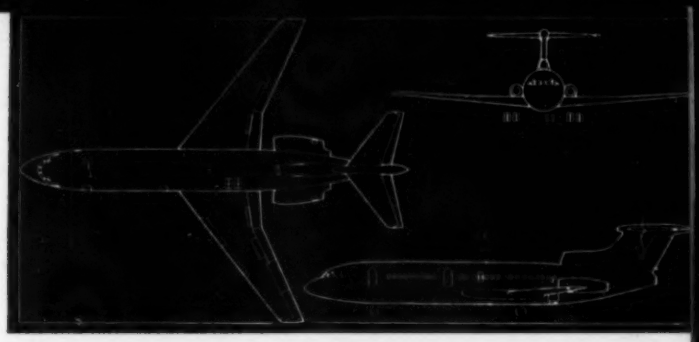
Etendard IVM development is aimed at producing an attack fighter with long endurance and good load-carrying capability and which can be operated from the smallest existing aircraft carriers. The airframe was from the beginning planned to fit snugly around a single, non-afterburning SNECMA Atar engine. A considerable portion of the rear fuselage is simply a fairing round the rear of the engine, and the distance between the engine and the aircraft skin is at this point only 2 cm. Because the undercarriage had to be lengthened for carrier operations, the size of the rocket bay immediately aft of the nosewheel had to be reduced, and the rocket pack was replaced by a fuel tank. A detachable pack of two 30 mm DEFA guns forms the only inboard armament.

Oxygen and radio are stowed in the dorsal spine, and electrical equipment, weapon controls and air conditioning occupy the space between the intake ducts immediately aft of the cockpit. Some fuel is stowed in flexible tanks further aft astride the ducts, but the main load is contained in the "wet" wing torsion box, and within the "wet" wing carry-through structure. The last few feet of the wings are arranged to fold upwards for carrier stowage.

The fully powered controls include a single-piece slab tailplane and conventional ailerons supported by perforated spoilers ahead of the flaps. Aileron span has recently been considerably reduced. High-lift devices of the normal Etendard IVM include large, rearward-extending slotted flaps and a drooping leading edge. "Dog-tooth" extensions are also standard. When the high-lift devices are extended, elevator-like surfaces on the slab tail are deflected upwards for trimming purposes. In this configuration, powered by a SNECMA Atar 8, the Etendard IVM will very comfortably operate from the new French carriers *Foch* and *Clémenceau*, but one of the pre-production batch is being fitted with a Rolls-Royce Avon 150 and blown flaps. The aircraft should fly in October and it is claimed that it would be capable of using the short 103ft-long catapults of the small carriers. It has even been mentioned that take-off lengths of less than half this distance might later be achieved.

A low-level radius of action of several hundred miles will be considerably stretched in production versions by the fitting of flight refuelling with a probe extending beneath the nose. Dassault claim that several countries are actively interested in the Etendard IVM for use from small aircraft carriers. In this category, Canada, Brazil, Holland, India and Australia immediately come to mind.

C. M. L.



Dimensions of the new D.H.121 are: span, 89ft 10in; wing area, 1,350 sq ft; sweepback (¼ chord), 35 deg; length, 104ft; fuselage diameter, 12ft 1½in (outside), 11ft 7½in (inside); cargo and baggage, 620 cu ft; tailplane span, 33ft 6in; wheel-track, 18ft 8in

AIR COMMERCE

AIRCO D.H.121: PRELIMINARY DETAILS

THE Airco group, de Havilland, Fairey and Hunting (for which D.H. have overall design responsibility), have just issued a specification of the revised D.H.121. As reported last week, a final contract was signed by B.E.A. on August 12 for 24 aircraft for delivery in late 1963. Fuller design details will be given next week; meanwhile here is an interim report of salient facts.

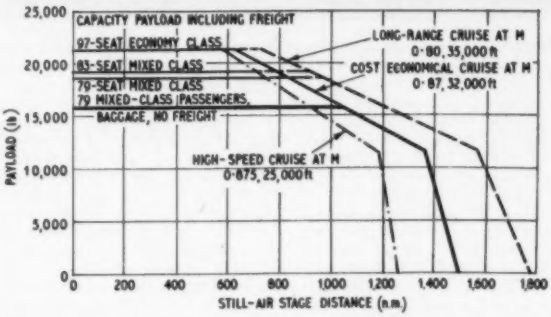
The new design, when compared with the original project for which a provisional order was placed by B.E.A. in February 1958, is dimensionally scaled down in all respects except for fuselage diameter. Rough comparison with the model exhibited at Farnborough in 1958 suggests (approximate figures) that span is reduced by 17ft, wing area by about 30 per cent, fuselage length by 13ft, and tailplane span by 4ft. The number of windows on the port side is reduced from 32 to 24; passenger seating is reduced from a six-abreast maximum of 111 to 97.

Nothing except its static take-off thrust (10,100 lb) has been released about the RB.163; but power/weight ratio of the new D.H.121 (0.289) compares with that of the earlier 123,000 lb design with three RB.141s of 12,000 lb (which eventually went up to 13,500 lb).

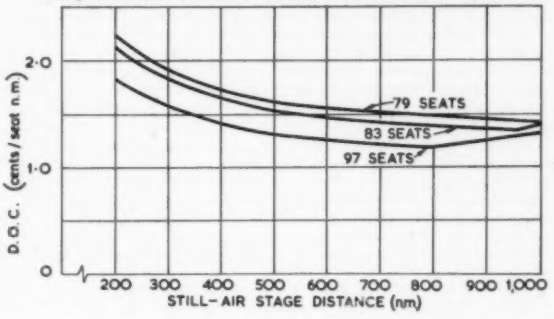
Of particular interest (see drawing) is the economy of the off-centreline nosewheel's stowage-space, and the novel retraction of the swivelling "co-axial-quad" mainwheels. Another external difference is the considerably increased thickness—and "waisting"—of the tailplane shock-body. (Though the 121's fuselage fineness-ratio is up by more than 10 per cent, design Mach number remains the same.)

AIRCO D.H.121

Three Rolls-Royce RB.163 by-pass turbojets of 10,100 lb st. thrust each
Weights. Max. all-up weight, 105,000 lb; maximum landing weight, 100,000 lb; maximum zero fuel weight, 85,000 lb; typical operating weight empty (83-seat mixed), 63,200 lb; space-limited payload, 97 economy-class passengers (at 158 lb each) with baggage (at 40 lb each economy class, and at 60 lb each first class), mail and freight (all stowed at 10 lb/cu ft), 21,500 lb; tankage, 3,840 Imp. gal.
Performance (standard conditions). Payload-range (see graph); operating cost (see graph); maximum cruising speed, 606 m.p.h. (526 kt) at 25,000ft (M=0.875); "cost economical cruise," 585 m.p.h. (508 kt) at 32,000ft (M=0.87); design limit speed M=0.95, or 478 m.p.h. (415 kt) E.A.S.; take-off airfield length required, for a 1,600 st. m. stage length (with "cost economical cruise" and reserves as quoted for the payload-range graph), 6,000ft; respective landing (no reverse), 5,450 ft.



(Above) payload-range capabilities. Assumptions: 45 min stand-off fuel at 15,000ft; 200 n.m. diversion; 1,000 lb approach fuel; 1,000 lb final reserve; 4½ per cent en route allowance. (Below) direct operating costs, A.T.A. Method, ten-year depreciation with 15 per cent residual value, and "cost economical cruise" at M=0.87 at 32,000ft



SOUTHALL: THE AFTERMATH

LAST week was summarized the report of the public inquiry into the accident (at Southall, Middlesex, on September 2, 1958) to Independent Air Travel's Viking G-AIJE. Below are given the main recommendations of the report and a summary of points raised subsequently in the House of Commons.

Recommendations of the Report. *Air Navigation Order:* The fact was exposed that statutory flight time regulations for the crew of public transport aircraft could be legally exceeded if aircraft were flown without goods or passengers during "rest" hours. The commissioner described this as "obviously ridiculous" and suggested that the minimum rest time should apply before *any flight* took place.

Tuning A.D.F. equipment. Pilots should be warned of trying to tune to a beacon outside its service range; a danger lay in not appreciating the risk this entails. A.D.F. equipment should also be better positioned.

Records of Maintenance. Records of defects should be made in duplicate at the termination of each flight, so that only one copy is carried in the aircraft. The record should be preserved for two years.

Repairs should only be classified as "emergency" where an aircraft, for a reason beyond the control of the operator or crew, lands at an airport where facilities exist only for carrying out temporary repairs.

* * *

As a sequel to publication of the report it was revealed that prosecution of Independent Air Travel for infringements of the Air Navigation Regulations was pending at the time of the accident. Prior to this the airline had been inspected by the M.T.C.A. on eight occasions in the previous 31 months. Applications by the company to operate scheduled services were withheld for over 12 months and it was only granted the right to operate *ad hoc* trooping flights on the sixth inspection. The eighth inspection just before the accident revealed *prima facie* evidence of infringement of flight-time regulations and approval for the company to operate scheduled services was withdrawn.

During the Civil Aviation debate on July 20 the Minister of Transport and Civil Aviation, Mr. Harold Watkinson, was questioned about the recommendations of the report—notably those on flight-time regulations, on the checking of pilots, and on matters of administrative safety. It was then that the Minister announced the idea of a new central licensing authority which would licence operations—"trying to sort out routes and services"—and organizations, and would enable the Ministry (as urged by the British Independent Air Transport Association) to revoke the licence of unsatisfactory operators.

The concept has been broadly explained by Mr. Eric Rylands, president of B.I.A.T.A., in a letter to the *Financial Times*. Mr. Rylands suggested that at present statutory requirements could too easily be complied with by providing the bare minimum in a purely quantitive manner. The granting of a licence would be conditional upon the applicant satisfying the authorities that his facilities, organization, personnel and equipment were fully adequate. Violation would be met with severe penalties.

With regard to changes in flight-time limitations, the Minister said that he hoped that the time spent flying an empty aircraft, which is not counted against a pilot's time on duty, would be dealt with in a general revision of the Air Navigation Order before the end of the year. As to checks on pilots, the Ministry has no powers of enforcement, but could only advise and "try to secure that the airline companies carry out this checking system." The system had been tightened up some time before the accident took place. "But," added the Minister, "no department . . . can guarantee that no firm . . . will ever succeed in breaking them."

The debate also brought to light an apparent loophole in the present system of granting applications to operate scheduled services. It was alleged that although Independent and Falcon were not approved by the A.T.A.C. to carry passengers on scheduled services, both companies were operating inclusive tours to the Continent. It was reported by Mr. A. E. Cooper, M.P. (who is chairman of Independent Air Travel) that neither the name Blue Air, under which I.A.T. intend to operate, nor the name Independent, appeared on the company's aircraft.

Installed at San Francisco airport is American Airlines' mobile finger. The longer passageway is wheel-mounted and telescopic

B.O.A.C. Comets on the North Atlantic are being equipped with economy-class seats until October 20. The seat designers are Microcell

VICKERS VC.11

NOW being shown to airlines that are shopping for short-range jets is a Vickers project designated VC.11. Nothing can be revealed about it, though it can be assumed to be in the D.H.121 or DC-9 capacity/weight/power class. Among those airlines shown the project are, according to their president, United, who want to start taking delivery of a large fleet of "small" jets in January 1963. Their choice will be made in June next year.

The fact that Vickers are offering a "small" jet now, having declined in 1957 (despite B.E.A.'s predilection for a Vickers-built Viscount replacement) to meet B.E.A.'s requirement, may well be traced to: (1) The recent B.E.A. new thinking about the 121, which has finally led to a revised 121, and (2) to an upsurge of interest in the short-range jet throughout the air transport industry.

Does the VC.11 conflict with the Vanguard? Again, is Vickers' belief in the big-capacity turboprop as *the* economic answer for short hauls less strong than it was? The answers (in the light of Vickers' £10m private investment in the Vanguard) can only be a decisive no. Indeed, the very strong signs of new airline determination to cut fares (the I.A.T.A. meeting at Honolulu may produce the long-awaited break-through) has probably renewed Vickers' faith in the price-cutting appeal of its new turboprop.

There is no dichotomy: if it is right for the airlines to operate jets and turboprops in the short ranges—as they will—it is right for a manufacturer who wishes to remain in the big league to offer both brands of airliner, especially to such a different time-scale.

TROOP SCOOP

THE major share of the trooping business for which Government contracts are awarded to British independents is now in the hands of Hunting-Clan. This remarkable fact became apparent when the Air Ministry recently awarded the new Cyprus, Kenya and Aden contracts to this operator. It may be recalled that, on April 15 last, after a year of doubts (*Flight*, January 16 and February 27), Hunting-Clan were awarded the contracts to Singapore and Hong Kong.

The new services, like those inaugurated on May 15 last to the Far East, will be operated as from October 1 by the two Britannia 317s owned by (and in the colours of) British and Commonwealth Shipping Co. Ltd. On the Nairobi and Aden routes these Britannias will be supported by DC-6Cs, and vice versa on the Cyprus route.

These awards reaffirm Hunting-Clan's 1956 act-of-faith order for Britannias—an order which, less than a year ago, did not seem to be justified by work-prospects at that time. The possibility that another Britannia or DC-6C will now be acquired (especially if any of Hunting-Clan's "V.L.F." applications materialize) cannot be ruled out.

Reactions among other independents, who competed closely for the trooping contracts, might be summed up as: "The lowest bidder won." If indeed this was the case (and assuming that the winning tender will prove profitable), the great shipping concerns behind Hunting-Clan—British and Commonwealth Shipping and the Hunting Group—can regard with satisfaction this renewal of their commercial stake in British aviation.

CARGO HOLDS FOR THE FUTURE

THE last few months have witnessed a resurgence of optimism about the future of all-freighting. For years the airlines have talked about the need for 5d per ton-mile operating costs to break into "the vast untapped airfreight market"—and yet have continued, with but few exceptions, to carry the bulk of their freight in the holds of passenger aircraft. And the few specialists —for example Flying Tiger, Seaboard and Western, Riddle—have continued to trade with modified passenger aircraft.

In this country the first positive breakthrough came last January and February when the Government, after a year or more of hesitation, decided to buy AW.660s and Short Britannics for R.A.F. Transport Command. Though fundamentally different in specification and time-scale, these two aircraft have set the pattern for the future of British medium-haul and long-haul military and civil air freighting.

No less significant were the commercial all-cargo airline orders placed, in February and May respectively, for AW.650 Argosies (1960 delivery) and Canadair CL-44Ds (1961). The American all-cargo line Riddle gave A.W.A. a provisional order for four Argosies; Seaboard and Western ordered five Canadair CL-44Ds, and Flying Tiger Line ordered ten Canadair CL-44Ds. Three cargo specialists, for the first time, were staking their futures in aircraft designed specifically for air freighting. "Our order," said Flying Tiger, "should lead us to the long-sought ton-mile tariff of 10 cents as compared with today's 20 cents."

Meanwhile, Lockheed continued to promote very hard the commercial version of the C-130B Hercules—an enlarged variant designated GL-207 Super Hercules (to be powered by Allison T61s of 5,500 e.h.p.). This classic freighter design received its first commercial reward in July when—no doubt influenced by the CL-44 orders of Seaboard and Flying Tiger—Slick ordered six and Pan American 12, for 1962 delivery. Admittedly these orders were not quite so firm as those of Flying Tiger and Seaboard for the CL-44, since both Slick and Pan American have made their orders provisional upon U.S. Government support for the C-130B.

That this may be forthcoming now seems evident from the trend of U.S. Government policy towards the future freight capacity of MATS. After months of deliberation by Senate sub-committees, one of whose objectives has been the matching of civil and military all-freight requirements, a sum of $30 million has been provisionally allocated to the re-equipment of MATS cargo fleets. Two types are likely to be ordered: a swing-tail modification of either the DC-8, Boeing 707 or Convair 600 for a cargo "alert force"; and a substantial number of C-130Bs.

Douglas, Boeing and Convair have all been tendering for the so-called "CX" cargo jet requirements, and each has offered a swing tail, turbofan version of its commercial jet transport. Whichever company wins, however, there will remain the significant fact that the world's leading commercial cargo specialists—Flying Tiger, Seaboard and Western, Slick, Riddle, Pan American—have all elected to place firm or provisional orders for turboprop-powered types. This fact certainly supports the British decision to choose the turboprop Britannic.

What of the market for converted piston engine fleets? The fact that American Airlines and United Air Lines are both converting DC-7 fleets to all-freight work is significant; but the fact that new orders for specialized aircraft like the Argosy, CL-44 and Super Hercules should be placed *despite* the opportunities for piston-conversions is perhaps even more significant. American have placed an order with Douglas for the conversion of ten DC-7Bs, and United have given Douglas an order for six DC-7s.

An interesting sidelight on the all-cargo market, suggesting that optimism about the future is tempered with caution, came from recent hearings before Congress, where the U.S. Government is being urged to provide U.S. all-cargo airlines with Government-guaranteed loans for all-cargo aircraft, and with subsidies to meet interim operating needs.

The president of Riddle Airlines, Mr. George L. Giles, said: "The C.A.B. has buried the need for immediate relief in ponderous proceedings . . . which will not be concluded for many months. For a drink of water needed now, the Board have sent us off to dig a well." He pointed out that while trunk lines were getting about 54 cents per revenue ton-mile, local airlines about 70 cents per ton-mile, the all-cargo carriers were getting only about 11 cents. Comparing the C-46 with the AW.650 Argosy (which Riddle has ordered), Mr. Giles quoted total operating costs for each type, respectively, at 21.9 cents and 16.45 cents. He incidentally considered it "incredible" that the U.S. Government, through the ExIm Bank, should subsidize foreign carriers while ignoring the plight of its own cargo carriers.

"Flight" photograph

Last week the Vertol 107 (two Lycoming T53s) was demonstrated to B.E.A., the British Army and Bristol Aircraft. It is seen here at Battersea heliport being flown by Capt. Cameron, head of B.E.A.s helicopter flight

FREIGHTING TO MOSCOW

THE application from Skyways to operate all-cargo services to Moscow will, it is understood, be opposed by B.E.A. at hearings before the A.T.A.C. Under the terms of the Air Corporations Act, Skyways would operate as "associates" of the Corporation, just as they are associates of B.O.A.C. on freight services to the Far East; but B.E.A. evidently wish to keep the potential U.K.-U.S.S.R. freight business for themselves.

At present, freight can be uplifted by B.E.A.'s Viscounts on the Moscow route only at the expense of already-limited (by fuel) passenger loads. More freight space will be available when Comet 4Bs replace Viscounts at the turn of the year; but no doubt B.E.A. wish to keep available for the Moscow route the big freight capacity of the Vanguard—which can (as is the Viscount at present) be utilized for freighting in off-passenger-peak hours.

Skyways have applied to operate up to seven services weekly with Hermes, Yorks or Constellations for a period of seven years.

TRANSAIR DC-3 ACCIDENT

ON August 19, G-AMZD, a Transair Dakmaster under inclusive-tour charter to the National Union of Students, crashed near the summit of the Pico del Hombre peak in the Montseny mountains 25 miles north of Barcelona. There were no survivors among the 29 passengers—most of them students—and three crew who were on board.

The accident occurred on a flight to Gatwick which left Barcelona just before 1500 hr. Although the weather elsewhere is reported to have been good, the mountain which the aircraft struck (about 300ft from the summit) was shrouded in mist. G-AMZD had left Barcelona about ten minutes previously and was then at about 5,570ft. This was Transair's first accident since they started operations in 1947.

YOU MUST HAVE RADAR

THE Federal Airways Administration is to introduce legislation which will require all U.S. civil transport aircraft to be equipped with storm-avoidance radar. It seems fairly certain that the requirement will become law; but the process is naturally a slow one, as agreement on details has to be reached with the industry and with operators, and a deadline date must be fixed sufficiently in advance to allow time for installation.

This decision has no doubt been prompted by the accident in April to a Capital Airlines' Viscount (see *Flight*, June 12) and the significant proportion of incidents and accidents which have been attributed to turbulence, hailstorm damage, and lightning; about 20 per cent of all reported incidents are due to these causes.

A similar requirement for storm-avoidance radar has yet to be proposed in Great Britain, despite the lack of precise information on the whereabouts of severe areas of turbulence during European summer conditions, and the resulting departures from best tracks. Although all new British aircraft on order have provision for fitting airborne radar there still remain about 350 in use by the two Corporations and the independents which are not so equipped. At £4,000 per aircraft for the basic equipment—which does not include labour—British operators would have to find at least £1½ million if every aircraft were to be retrospectively fitted.

Each year a significant number of British airliners are also damaged by hail or lightning strikes or are subjected to severe turbulence. Pilots of aircraft not fitted with weather radar can be faced with the choice of pressing on through a threatening cumulo-nimbus—possibly at a fuel-wasting altitude—or of making a wide detour off the airway, thereby upsetting separation standards.

The extension of A.T.C. cover and increasing air traffic prompts the fitting of radar to all our present aircraft. Storm-avoidance radar, along with its ancillary functions of navigation, might well be considered as a subject for new United Kingdom legislation to ensure that existing aircraft can be operated in the safest and most economical way.

LONDON'S NEW LONG-HAUL TERMINAL

ONE of the features of the 1957 Millbourn report on the development of London Airport (*Flight*, August 9, 1957, page 201) was the proposal to adopt the finger-and-gate, or pier, passenger-handling system throughout the central terminal area. It is surprising, therefore, to learn that the long-awaited new long-haul terminal in the central area (the so-called "South West Passenger Building") which will replace the present north-side shanty town, is to be built initially without fingers (see sketch below).

Brief details of the projected building were issued simultaneously with the announcement by the Minister of Transport that tenders have been invited for its foundations and steelwork. The first part is planned to come into operation as a terminal for B.O.A.C. and its associates in the latter half of 1961, followed by other long-haul operators some six months later.

So far the only drawing released is a simple outline plan. More informative perspective drawings, prepared by the architect, Mr. Frederick Gibberd, are promised next month.

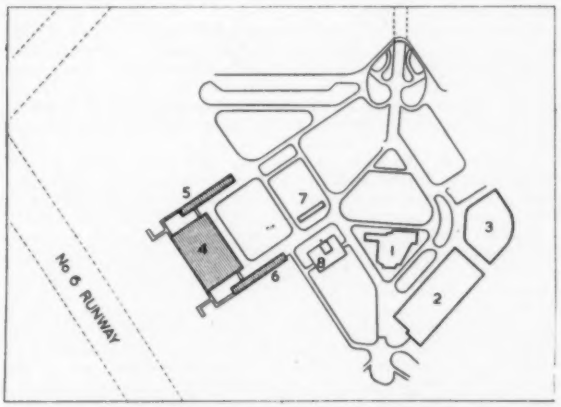
Meanwhile we are told that the building will provide a central two-storey block (432ft × 282ft) for passengers, linked by bridges to two three-storey office blocks (each 412ft × 57ft), with an enclosed court for parking cars and buses.

Designed to meet the needs of the next ten years, during which the number of long-haul passengers is expected to grow to 2.4 million a year, the terminal will cater for the simultaneous arrival of up to five large aircraft.

On the all-important question of passenger-handling, the official press notice states that "in order to avoid discomfort due to noise and blast, it may be necessary at first to take passengers to their aircraft by coach, even though the majority of stands will be very close to the terminal building." It adds that present plans call for the eventual building of a finger or pier system, but that these intentions may be modified in the light of further experience.

It is clear from all this that the bugbear of indecision which has hindered the development of London Airport for the past decade is still with us. However, it is only fair to admit that fingers no longer appear to be so perfect an answer to passenger-handling problems as they did in 1957.

There have been many criticisms of Gatwick's single long pier and, as reported in *Flight* on April 24 (pp. 588-9), the new Washington Dulles International Airport at Chantilly, Virginia, has reverted to a sophisticated type of apron coach in preference to fingers.



1, control building; 2, passenger building; 3, Queen's Building; 4, passenger building; 5, office block; 6, office block; 7, fuel depot; 8, central heating station

If fingers are added to the new long-haul terminal in due course, they will run out parallel with No. 6 runway, from the ends of the two L-shaped ramps shown on the plan drawing. This would be in accordance with the Millbourn recommendations.

On the other hand, enquiries have elicited proof that the oft-proposed alternative of subways is still very much in the running. With subways, the ramps would simply continue down, under the apron, to a central hall from which escalators would lead up to each aircraft stand. Passengers would have to travel on foot even further than with fingers; but the use of subways would eliminate long buildings and coaches from the already-crowded apron and would reduce the jet problems. It would, almost certainly, be the most costly of the three alternative passenger-handling techniques.

AIR COMMERCE . . .

ELAND CONVAIR ELAN

COST of a Canadair kit for the conversion of Convair 340/440s to Napier Eland turboprop power is about £147,000 ($410,000), plus the cost of about 6,000 man-hours. The cost of a new Canadair 540, with Napier Elands installed on the production line (*à la* CL-66s for the R.C.A.F.) is about £430,000 ($1.2m). Overhaul life of the Napier Eland NEL.6 is approved at 400 hr: this is expected to rise to more than 1,000 hr as flying time—at present said to be 20,000 hr—is increased. The possibility of different lives between the hot and cold parts of the engine is being considered.

These facts were given, in answer to questions, by Sir Archibald Hope, of Napier Aero-Engines Ltd., at a Press demonstration of the Canadair/Convair 540 at Gatwick Airport.

The occasion was a curtain-raiser to a European tour which was to take the aircraft (actually the original 340 converted by Napier at Luton in 1955) to Stockholm (S.A.S. Linjeflyg); Helsinki (Finnair), Zurich, Geneva, and to cities in Spain, Portugal, Germany, Belgium and Austria. There were also to be demonstrations to unannounced British independents.

The official designation of the Napier-Eland powered Convair is *Canadair* 540 for a new production aircraft built by Canadair, and *Convair* 540 for a conversion from 340/440 standard either by Canadair or by PacAero. The last-named firm is also engineering the competing Convair turboprop version by Allison.

THE REWARDS OF PERSEVERANCE

RECENT issues of British Civil Airworthiness Requirements* by the Air Registration Board, and Special Civil Air Regulations† by the American Federal Aviation Agency, dealing with the subject of performance requirements, conceal rather than reveal a noteworthy effort in Anglo-American co-ordination.

The story begins as long ago as 1948. At that time the Americans had a firmly established set of performance rules which had been developed to meet the aeroplanes of that generation. There were, however, features which did not appeal to the British. For instance, the absence of account for temperature, the fact that the required rates of climb were related to the square of the stalling speed, the lack of account for stopways and clearways, and the apparently unsatisfactory distinction between four-engined and twin-engined aeroplanes—all were sources of objection.

The British dislike of the American requirements was basically that these took insufficient account of differences between one aeroplane type and another, and between one set of operating circumstances and another. Thus as aeroplanes and operating conditions departed from those for which the U.S. code was devised, the greater the variation of safety levels and economic penalties would become.

In the absence of a large background of experience on which to justify these objections, the British began to explore the possibility of building up performance requirements from first principles. Staff of the A. and A.E.E. at Boscombe Down developed a new approach whereby the required level of performance could be built up by rational steps backed by statistical analysis.

Armed with this new method, the Air Registration Board, backed by the British industry and others concerned, began the long and at times seemingly impossible task of establishing it internationally. In the first instance it was necessary to develop a practical working method for domestic use, and such a system was introduced in the 1951 British requirements. Meanwhile, discussions began at I.C.A.O., the British striving to obtain international acceptance of the new system. A Standing Committee on Performance was set up which, in the event, proved to be a remarkably fine example of the possibilities of international technical co-operation. In retrospect it may now seem that the performance code which the I.C.A.O. Committee developed on the basis of the British idea was too refined and complex; but the value of its contribution cannot be over-estimated.

Despite the technical progress made by 1954, the two basic methods remained in practical use. Comparison was difficult. While the overall safety level offered by the two methods was not measurably different, in any particular set of circumstances the two codes could result in large differences in all-up weight. Moreover, the Flight Manual and operational rules differed sufficiently to cause difficulty and confusion. Thus there followed a not unnatural international demand to select one code or the other; and, as British experience was still relatively slender, the preference was for the American code.

Circumstances began to change in 1957, when the construction of civil jet aircraft in America precipitated a substantial change in U.S. domestic rules, at least for turbine-powered aircraft. Meanwhile British experience had sufficiently advanced to remove any fears that the British method was untried.

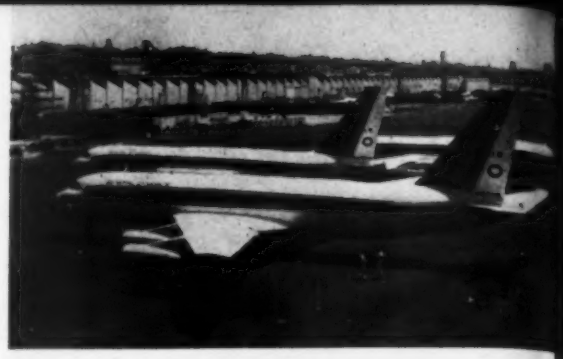
In 1957 the Americans embarked on a revision of the whole form of their requirements, many features of the British requirements being reflected in the changes. This done, the two codes were on a comparable basis and it became possible to achieve alignment in more detailed respects. A study of the outcome clearly shows that there has been reasonable give and take on both sides, with a closing of important gaps. The British requirements have lost some of their earlier refinements, no doubt having gained from practical American experience.

This process of closing the gaps between American and British requirements ("going through the two codes line by line," as Mr. R. E. Hardingham has said) has encouraged resumed efforts in I.C.A.O. At meetings in 1958 and 1959 the Airworthiness Committee has developed a single international performance specification. While on the surface there are now three codes, British, American and I.C.A.O., in fact the differences among them are a mere residue of earlier fundamental differences and the way is now clear for universal agreement.

It is perhaps unwise to moralize, but there seems to be an underlying lesson. The unwillingness of the British authorities to give up a system in which they had confidence, despite the fact that it was necessary to "go it alone" for nearly a decade, has in the end borne fruit.

*Section D of *British Civil Airworthiness Requirements, Issue 4, March 1959.*

†*Special Civil Air Regulations SR-422, August 1957; SR-422A, July 1958; SR-422B, July 1959.*



Taking time off from flight tests for publicity purposes, the first three Convair 880s pose together for the camera on the flight line at San Diego. First delivery, to T.W.A., will be in November; Delta will receive their first 880 in January. The 880 is "right on schedule"

JET SWAPS

AN arrangement made between PanAm and T.W.A. for the interchange of short-range and Intercontinental Boeing 707s will result in PanAm operating only 707 Intercontinentals.

PanAm's original order was for 17 Boeing 707-321s and six Boeing 707-121s; T.W.A.'s for 15 707-131s and 18 707-331s. Hughes Tool Co. (T.W.A.'s controlling shareholder) now have an option to take over six short-range -121s from PanAm (for about $32m) and PanAm are to purchase six -331s from T.W.A. (for about $40m, a net exchange in T.W.A.'s favour of about $8m). Hughes Tool's option to do this expires on September 30, the date when the arrangement by which T.W.A. leases its Boeing 707-131s from Hughes Tool Co., at $2,500 a day, also comes to an end.

The line-up of the new fleets may thus be: PanAm, 17 707-321s, 6 707-331s; T.W.A., 12 707-331s, 21 707-131s.

Other swaps have been made by T.W.A. and Northeast, and by PanAm and National. The former agreement (not yet approved by the Civil Aeronautics Board) provides for Northeast chartering probably one 707-131 and two 707-331s for its New York - Miami route during the peak winter season between September 1 and May 1, 1960. The lease arrangement is unusual; Northeast will pay T.W.A. $3.10 per aircraft mile ($6,776.60 per round trip) plus 50 per cent of the gross passenger revenues between $4.50 and $5.30 per revenue aircraft-mile and 25 per cent of gross passenger revenue if this is above $5.30 per revenue aircraft-mile. The agreement should place Northeast in a competitive position against National (operating PanAm 707s) and Eastern, who will put DC-8s on to this route, although not in time for the start of the season. (It will be recalled that, due to flight crew troubles, Eastern's hopes to introduce Electras in time for last year's season were dashed.)

National's agreement with PanAm is more controversial than the arrangement made for the short-term lease of 707s by Northeast, since it involves a transfer of shares. The arrangement covers the lease of aircraft for the 1959-1960 season and a ten-year reciprocal lease of jets at peak seasons along with the reciprocal purchase by each company of 400,000 shares and the right for PanAm to buy an additional 250,000 shares in National. Whether it would do so depends upon the load factors achieved during the short-term lease. This could give PanAm a total holding in National of 35 per cent, an arrangement of which the C.A.B. has disapproved.

UP WITH FARES—

FARES charged by American domestic carriers should now be fixed at 12 per cent above those in effect before the date of the last temporary increase, February 10, 1958. This has been recommended by Mr. Ralph L. Wiser, C.A.B. examiner, as the first result of the long drawn out General Passenger Fare Investigation.

This story goes back to 1957 when a group of domestic airlines sought immediate fare increases varying from 12 to 20 per cent. These demands were a sign not only of rising costs but more particularly of the financial loads imposed by the heavy jet purchasing programmes of 1955 and 1956. The "G.P.F.I." was charged with the task of examining the situation thoroughly and calmly. Since then, of course, the airlines have climbed out of America's serious business depression, of which the nadir was in April 1957. And, indeed, they have enjoyed "temporary" fare increases amounting to 10 per cent: an increase of 4 per cent plus one dollar per ticket (awarded in February 1958) plus the elimination of certain promotional-fare discounts—all this amounted to a general increase of the order of 10 per cent.

The C.A.B. examiner also recommended that fares should be determined not so much as a profit percentage of revenues, but as a return on capital investment. For the big carriers he found that a reasonable rate of return would be 10.25 per cent and for the other trunk carriers 11.25 per cent (the difference was due to the different ratios of "debt-to-equity" for the big four and the other trunk lines, respectively 45 : 55 per cent and 50 : 50 per cent). This makes an average for the 12 trunk lines of 10.6 per cent.

On the crucial question of depreciation (which the airlines have always felt should be for management and not the C.A.B. to determine), the examiner proposes: (1) piston equipment should be depreciated on a seven-year basis; (2) jet and turboprops over ten years; (3) jet and turboprop engines over five years; (4) 15 per cent residual value for all flight equipment except for jet and turboprop engines, which would have zero residual value.

During the final stages of the G.P.F.L., which were devoted to oral argument, it appeared that most U.S. carriers favoured a raising of fare levels by 15 per cent above the February 1958 levels—as compared with 12 per cent recommended by Mr. Wiser. The only voice raised against any increase at all came from the C.A.B.'s own Bureau of Air Operations, which argues that fares should be reduced from present levels by 4.6 per cent now, and by a further 4.75 per cent on July 1, 1960.

—DOWN WITH FARES

THE Air League of the British Empire proclaims that cheap air fares are practical *now* on most routes. This statement is the result of the deliberations of an Air League committee of four: Sir Archibald Hope, a director of D. Napier & Son; Mr. Peter Masefield, managing director of Bristol Aircraft; G/C. Douglas Bader, managing director of Shell Aircraft; and Mr. P. Ll. Hunting, chairman of the Hunting Group.

The advantages of low fares as seen by the committee are: (1) The stimulation of traffic; (2) the opportunity to employ existing aircraft; (3) the promotion of more British air transport; (4) the provision of new markets for British aircraft; and (5) creation of more employment in the manufacturing and operating industries. The committee proposes that lower fares —of the order of 3d or 4d per passenger mile—could be achieved with fully depreciated, slower aircraft for scheduled operations, a fare differential of 20-25 per cent, and the use of economic modern aircraft by low-cost operators.

The League do not propose a break-away from I.A.T.A. to achieve fares of this order, but recommend that a "strong line" is taken at I.A.T.A. rate-fixing conferences. Introducing the policy, Sir Archibald Hope and Mr. Masefield repeatedly emphasized that if a sufficiently rigid attitude was taken within I.A.T.A. it would prevail, but in any case the Government must back up low-fare demands made by British airlines within the Association. And they might make a start (as the Minister of Transport and Civil Aviation has already twice warned that he may) by authorizing cheap fares on British colonial routes. Resulting threats to traffic rights could, say the League, be largely ignored; the U.K. "controls such a large volume of traffic that even if foreign airlines object, a firm line by Her Majesty's Government will prevail." Diversion, the League considers, is just a bogy —the new low fares will create new traffic.

Can these low fares (about half of present-day rates) be obtained with reasonable comfort, reasonable frequencies and reasonable load factors? Yes, says the League, by using written-off aircraft. Mr. Masefield suggests that a fully depreciated Viscount, on a stage length of 1,000 miles, could break even on a 50-55 per cent load factor even selling its seats at 3d per mile. Domestic services need to be made very much less expensive (in terms of spending power European operators charge four times more than American domestic carriers over similar distances) and a start could be made by removing the fuel tax which costs B.E.A. £1m annually on domestic services alone.

BREVITIES

The annual conference of the Aerodrome Owners' Association will be held at Bristol on September 24 and 25.

* * *

Maximum weight of the Handley Page Dart Herald has been approved at 39,000 lb, an increase of 2,000 lb. Most of this will be used as payload which, say Handley Page, will be boosted by as much as 25 per cent.

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United are to start U.S. transcontinental services with DC-8s on September 18, a month ahead of the original schedule for the start of services. Delta's DC-8 operations are to start on October 15 between Atlanta and Miami.

* * *

The 1959 Branker Memorial Lecture to the Institute of Transport will be read by Capt. Eddie Rickenbacker, chairman of Eastern Air Lines, at 5.45 p.m. on September 14 in the Jarvis Hall, 66 Portland Place, London, W.1. His subject will be "World peace through air transportation."

* * *

To date, B.O.A.C. have dismissed 40 stewards and two navigating officers for the alleged smuggling of precious stones and gold on the Corporation's Far Eastern routes. Whether or not the dismissed staff will face civil charges would, a B.O.A.C. spokesman is reported to have said, be a matter for the authorities of the countries concerned.

* * *

Boeing have announced that Pratt and Whitney JT3-D1 turbofan versions of the Boeing 707-120 will be designated 707-120B and will include wings modified "for higher maximum cruising speed and lessened runway requirements." All of American Airlines' 707s will be to 120B standard by 1962 and both American's 720s and Qantas' 707s are also to be turbofan equipped.

A.R.B. have issued further Civil Aircraft Inspection Procedure sheets dated June 15, 1959.

* * *

In the six months ending on May 31 this year Douglas lost £5,360,000 and have increased the price of the DC-8 from £1.78m to £1.95m.

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The Cornell-Guggenheim Aviation Safety Center of New York is to undertake a study of aviation safety research in Europe. The study will be conducted by W/C. B. R. Stanojlovic.

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Aer Lingus made a net operating surplus of £119,673 in the financial year ending March 31, 1959, compared with an operating deficit of £43,674 the previous year.

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Suidwes Lugdiens (Edms) Beperke—South West Airways (Pty.) Ltd. of Windhoek, South Africa, have been admitted as the tenth associate member of I.A.T.A. There are 80 active members.

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Sir Roy Dobson has said that A. V. Roe Canada is "investigating the possibility of producing civil aircraft," possibly in conjunction with U.S. manufacturers, at the Malton, Ohio, factory.

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The outcome of recent talks in London between the U.K. and Israel was that El Al will now run a third weekly Britannia service from London to New York.

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The Vanguard 951 has now completed all its flight resonance testing. Maximum true airspeed reached was 460 kt (in a dive) and maximum I.A.S. 403 kt, in contrast with the design speed of 370 kt. Vanguards have now completed 358 hr in 206 flights on three aircraft.

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A new Italian helicopter airline called Elipadana, Societa Alta Italia Transporti Elicotteri (SAITE) was officially formed in Milan during July. Services will start next year, but experimental services with a Sikorsky S.62 will be run this month between Milan, Elba, Venice, Trieste and Turin.

Representatives of Britain's three turbine airliners were recently photographed together on the apron at Havana airport, Cuba: a Bristol Britannia 318 of Cubana, a Vickers Viscount 755 of Cubana, and a de Havilland Comet 4 of Aerolineas Argentinas

Sport and Business

Pictured at Van Nuys Airport, California, recently, this Beechcraft Model 65—an unfamiliar type—is an eight-seater powered by two 340 h.p. Lycomings

AMONG recent events at Elstree was a Tea Patrol last Sunday in which about 30 visitors tried to get through a defensive screen of 10 defenders. Less than half-a-dozen made it. Another most successful occasion was a pilots' rally held on July 19, to which Elstree Flying Club had invited every privately owned aircraft on the British civil register. No fewer than 82 visiting aircraft arrived, including a number of Turbulents, Peter Masefield's executive Chipmunk and the familiar troupe of types which make up the present club and private-owner fleet. Geoff Worrall entertained the assembled company in Gloster's Gladiator, the club laid on a Chipmunk formation and beat-up, two parachute drops were made and the Tipsy Nipper was demonstrated.

New appointments at the Elstree club include that of Col. H. C. Butcher as club secretary. The duties of chief flying instructor have been taken over by John Schooling. The duties of both of these appointments were previously carried out by Edward Wild. Recent improvements in facilities at Elstree include the introduction of a new aircraft parking and taxying area which has effectively reduced the ground congestion on the aerodrome.

A TEA PATROL and At Home will be organized by Oxford Aeroplane Club at Kidlington on Sunday next, August 30. Tea-patrol time is from 3 to 3.30 p.m. and approach height 1,000-2,500ft. Also included in the programme is an inter-club landing competition.

PERSONAL PLANE SERVICES, the Douglas Bianchi company based at Woodley and White Waltham, has been appointed British agent for products of the Claude Rousseau Company of Dinard and can supply Rousseau Emeraude aircraft and parts.

THE M.P.M. FLYING GROUP, which was recently re-formed and is operating Magister G-AKKR from Elstree, has vacancies for new members. Inquiries should go to R. W. Mills, 68 Kennedy Road, Hanwell, London, W.7.

INAUGURATING a demonstration tour of Europe, the Near East and North Africa, the Transland Ag-2 "farm and forest airplane" will be displayed in the U.S. pavilion at the international Trade Fair at Zagreb during September 5-20. The aircraft was flown to New York from Torrance, California, and shipped by boat last month.

FIRST PROTOTYPE of a new single-engined four-seater by Beech Aircraft Corp. is due to fly by the end of this month. Designated the Beechcraft Model 33, it will be similar to the Bonanza but will have a conventional tail with a swept fin and rudder. Price of the new machine, which will be one of the company's range of 1960 models, will be about $20,000. Other recent news from Beech is that the installation of two lightweight Aerojet-General solid-fuel rocket engines as optional standby rocket power for the Twin-Bonanza has been approved by the Federal Aviation Agency.

DELIVERY of the first five production models of the Piper Pawnee agricultural aircraft was made late in July to Wes-Tex Aircraft Sales of Lubbock, Texas. Described and illustrated in our issue of December 19, 1958, the Pawnee will be among the aircraft which will be demonstrated at the forthcoming agricultural aviation conference at the College of Aeronautics, Cranfield. Pawnee production at Lock Haven is now scheduled at one per day.

AT AN INTERNATIONAL parachuting competition held in Leutkirch Allgau, West Germany, during June, Sgt. A. Charlton of Britain won the Class 1 contest (F.A.I. B-licence standard) and the British team came third in Class 2 (C and D-licence standard). Other team members were Sgts. N. Hoffman, M. McArdle, J. McLoughlin and Mr. Denis Lee, who all belong to the British Skydivers Club. On August 16 the same team performed a 76-sec delayed drop from 14,500ft over Thruxton, opening their parachutes at about 1,200ft.

METEOROLOGY AND SOARING FLIGHT is the subject of a course of eight fortnightly lectures organized by the Department of Extra-mural Studies of London University, to be given at the Kronfeld Club on alternate Thursdays beginning September 10. The lecturers will be Dr. R. S. Scorer and C. E. Wallington, and the eight sessions will be devoted to atmospheric energy radiation; weather charts and fronts; thermal winds and jetstreams forecasting; tephigram and fairweather clouds; storm clouds; artificial clouds and condensation trails; waves; and soaring weather situations. Fees are 10s for the course or 2s per lecture.

THE BRITISH GLIDING ASSOCIATION plans to organize two national gliding weeks next year, one from May 28 to June 6 and the other from July 23 to August 1. Following the resignation of Mrs. Yvonne Bonham, Miss Anthea Russell has taken over as secretary of the Association at Londonderry House.

THE 1959 FRENCH NATIONAL GLIDING CHAMPIONSHIPS, held at St. Yan from June 20 to July 5, were won by Camille Labar, an Air France engineer, with Jacques Lacheny second and Louis Trubert third. Lt-Cdr. Anthony Goodhart (Bréguet 905) came ninth and David Ince (Olympia 419) 15th in the international category. All the French pilots were flying Bréguet 901 aircraft.

RETROSPECT

From "Flight" of August 28, 1909

A Cross-London Prize: No less a prize than a one hundred guinea cup awaits the intrepid British aviator who first crosses the Metropolis from north to south or *vice versa*. The only conditions the donors, Messrs. P. B. Burgoyne and Co., attach to their offer are: (1) that every part of the machine be of British manufacture, (2) that the aviator be a subject of the King, and (3) that the Thames be crossed between Tower Bridge and Westminster.

This Bensen Gyro-Copter has been constructed by W/C. K. H. Wallis of H.Q. Fighter Command. It is powered by a 65 h.p. McCulloch two-stroke drone engine modified by W/C. Wallis to "long-life" standard. The hanging control column has been replaced by a conventional stick and the machine has been successfully flown from Shoreham, where S/L. J. Crampton took these pictures. A 15-20 m.p.h. wind is sufficient to speed up the rotor. Helicopter experience is an asset to flying, and very low landing speeds are possible. The machine is towed behind a small car for road transport

THE INDUSTRY

Blades for the BB.152

IN describing the East German BB.152 jet transport in *Flight* of March 27, we referred to the probability of Britain becoming a supplier of components, and several likely firms were named. Now we learn from Garringtons Ltd., of Bromsgrove, Worcs, that they are fulfilling a £50,000 order for turbine rotor blades for the Pirna O14 engines which power these aircraft; this is believed to be the first sale of gas-turbine blading by the West to an Iron Curtain country. The Bromsgrove firm add that "the blades, which are notable for their excessive taper and twist, are precision-forged by a special technique developed for this particular contract by Garringtons' Blade Division."

Jackaroo Designer's New Venture

A NEW company registered on August 11, Eric H. Smith & Co. Ltd., has as its directors Mr. E. H. Smith, D.C.Ae., A.F.R.Ae.S. (managing) and Mr. R. L. Smith. The former is chief designer to Jackaroo Aircraft Ltd., and he will retain this post. The new company, whose offices are at 71 Almners Road, Lyne, Chertsey, Surrey (Chertsey 2908), manufactures agricultural-aviation equipment and also undertakes design and experimental work and provides consultant and drawing-office services. The design organization is A.R.B.-approved.

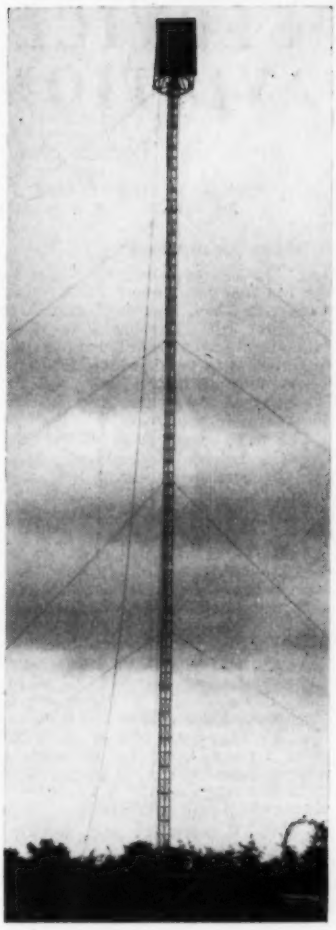
Measuring Rotor Unbalance

UNUSUAL flexibility is claimed for a method of measuring the unbalance of helicopter rotor blades under dynamic conditions which has been developed by the Wayne Kerr Laboratories Ltd. of Chessington, Surrey. Beneath the rotor is arranged a framework carrying a non-contacting probe located a few inches below the plane of rotation of the blades. The probe may be positioned at any point along the span and does not actually touch the rotor anywhere.

The central electrode of the probe has a surface area of very few square inches, and the surrounding guard-ring is of open mesh construction, offering very low resistance. From the probe signals are led to a Wayne Kerr bridge and ancillary equipment which separates the information obtained from each blade; one meter shows the distance between the probe and the blade chosen as a reference, while additional meters give a direct reading in inches of the vertical separation between each blade and the reference blade. Wayne Kerr suggests that the method may be adapted for a host of other measuring functions where small changes in position must be recorded without attaching anything to the part concerned.

High and Quick

WELL known in the aircraft industry for their "Giraffe" and "Safety Raiser" maintenance platforms, the firm of Access Equipment Ltd., Hemel Hempstead, Herts, have recently added to their products a series of masts ("Zip-Up towers") for carrying radio, radar and other equipment at heights of up to 200ft. Seven-foot triangular sections of braced aluminium tubing are employed, assembled by means of interlocking clips which dispense with the need for nuts and bolts. It is stated that a 130ft tower can be erected by five men in about four hours after a simple timber base has been prepared. For storage purposes a tower can be stripped down to basic components consisting principally of 7ft × 2in tubes. A number of these towers—including an enclosed-stairway version—are already in service in the U.K. and U.S.A.



130ft mast carrying a radar reflector

IN BRIEF

The new division of Sir W. G. Armstrong Whitworth Aircraft Ltd., formed when A.W.A. took over the technical developments division of Gloster Aircraft Co. Ltd. recently, will in future be known as Armstrong Whitworth Equipment. It is to manufacture and market a variety of hydraulic and fuel system equipment from the A.W.A. commercial electronic department.

Mr. A. W. Gregg has been appointed personal assistant to the managing director, and also public relations manager, of Westland Aircraft Ltd., Normalair Ltd., Westland Engineers Ltd. and the Unique Balance Co. Ltd. He will work in direct association with the sales departments of these companies and his duties embrace all aspects of public relations, publicity and advertising. Mr. P. G. Hering, publicity officer for Westland for the past five years, has been appointed press officer and will devote full time to liaison between the companies and the Press.

These flight deck crew-members, standing alongside a Scimitar of No. 803 Sqn. on board H.M.S. "Victorious," are wearing the new Type 13500 deck helmets developed by Amplivox Ltd. in conjunction with the R.A.E. and now issued for service. The ear-defenders have rigid-wall ear shells with liquid-filled seals, and an acoustic valve in each pad can be opened to receive direct speech. Provision is made for a boom-mounted noise-cancelling microphone. It is stated that the ear-defenders provide noise attenuation of over 45 db at the higher audio frequencies

Smiths Aviation Division have opened a new and comprehensive workshop for the repair and overhaul of aircraft instruments at their Bishops Cleeve factory in Cheltenham.

New London headquarters for the Firth Cleveland Group, at Stornoway House, Cleveland Row, St. James's, S.W.1, were officially opened on August 21.

Yugoslavia has ordered three instrument landing systems, and a quantity of V.H.F. and H.F. equipment, from Pye Telecommunications Ltd. of Cambridge. Pye state that the contract was secured in the face of very intense competition from countries in many parts of the world.

Simmonds Aerocessories Ltd., of the Firth Cleveland Group, have entered into a licensing agreement with the Pryor Manufacturing Co. of Mansfield, Ohio, to manufacture hydrant fuel dispensers and civil and military aircraft refuelling vehicles for a world-wide market except for the American continents.

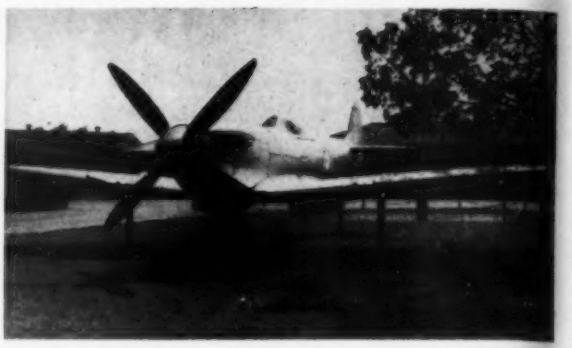
Aero-Enterprises (Boreham Wood) Ltd. state that as there appears to have been some confusion recently about the British representation of Piaggio of Genoa, they wish to make it clear that they are the exclusive U.K. representatives; it is the company's policy generally to sell through the trade, and no other concern holds the position of exclusive sales concessionaire.

Texas Instruments Ltd., the British associates of Texas Instruments Inc., and manufacturers of silicon semiconductor devices, have announced details of their new plant which is to be built at Mantons Lane, Bedford. Its total area will be seven times that occupied by the company's first plant which was opened in Dallas Road, Bedford, in October 1957.

Mr. G. Archer became chairman of the Mond Nickel Co. Ltd. and its subsidiary Henry Wiggin & Co. Ltd. from July 1, succeeding Mr. L. H. Cooper. Other new appointments announced include those of three managing directors of Mond, Mr. I. A. Bailey (operations), Dr. L. B. Pfeil (research and technical) and Mr. J. O. Hitchcock (commercial). Mr. Bailey continues as managing director of Wiggin and Dr. Pfeil and Mr. Hitchcock both continue as directors of that company.

SERVICE AVIATION

Royal Air Forces and Naval Flying News



This Spitfire, mounted as if in flight, stands at the South African Air Force Station Waterkloof in the Transvaal. Recently a Spitfire was sent from London to Perth, Western Australia, where it is being similarly mounted as a memorial

Arabian Command

WITH the appointment of Air Chief Marshal Sir Hubert Patch as Commander-in-Chief, British Forces Arabian Peninsula, from October 1 it has been announced that a new system of unified command is to be introduced in the area. Under this, the new C-in-C. will be in overall command of the three Services in his area of responsibility.

The next appointment of the present C-in-C., A.V-M. M. L. Heath, who has held the post since October 1957, is to be announced later.

Victor B.2 Lost

A VICTOR B.2 failed to return to the Armament and Aeroplane Experimental Establishment, Boscombe Down, after taking off on August 20 for a test flight. It was airborne at 1035 and due to return in about four hours. The aircraft was captained by S/L. R. J. Morgan, who had with him as crew S/L. G. B. Stockman, F/L.s L. N. Williams and R. J. Hannaford and a civilian test observer for Handley Page Ltd., Mr. R. H. Williams. It is reported that no messages were received from the aircraft during flight.

Reserves Club Progress

A MOST successful year, socially and financially, has recently been completed by the R.A.F. Reserves Club. During 1958-59 the newly formed Battle of Britain Fighter Association, the Guinea Pig Club and the Guild of Air Pilots and Air Navigators established headquarters there; and the Airborne Forces Club also shares the club's amenities at 14 South Street, London, W.1. Decorations have recently been carried out, refurbishing the premises from top to bottom; the latest accounts show a much-improved financial position; and the next important occasion, a dinner at the House of Commons in November, is already over-subscribed.

The R.A.F. Reserves Club is open to serving as well as former officers of the R.A.F. and its reserve forces and to representatives of a wide range of aviation activities, with a reduced membership subscription for civil airline pilots and crews. During the recent London - Paris race organized by the *Daily Mail* the club was used as headquarters by the R.A.F. team.

Air Marshal the Earl of Bandon, F.E.A.F. Commander-in-Chief, recently paid a three-day visit to Saigon.

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The Dowager Viscountess Trenchard has been appointed a vice-president of the R.A.F. Benevolent Fund, which was founded by her late husband, Marshal of the R.A.F. Lord Trenchard.

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Rear Admiral W. G. S. Tighe has been appointed Rear Admiral (Personnel), Home Air Command, from August in succession to Rear (now Vice-) Admiral J. S. Lancaster.

Part of a "Flight" photograph of a model of the Armstrong Whitworth Aircraft AW.660 exhibited at the Paris Show with hump-backed rear fuselage and rearward-opening doors. A version of this aircraft is to go into service with R.A.F. Transport Command

The aircraft direction and reporting ship H.M.S. *Chichester*, which has been in company with *Albion* (see picture below), berthed at Chatham on August 18 after steaming 50,000 miles and visiting five continents. She is the first vessel of her class to have been east of Suez.

No. 284, a helicopter squadron operating in Cyprus, has now been re-numbered No. 103 Sqn. It is commanded by S/L. J. L. Price, formerly C.O. of No. 284 Sqn.

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Officers from the Pakistan Air Force Staff College, Karachi, recently visited the Middle East Air Force. A. Cdre. C. B. E. Burt-Andrews, the college commandant, headed the party.

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No. 2 A.D.U., a wartime R.A.F. ferry unit operating in the Middle East, is holding its annual reunion at the R.A.F. Reserves Club, 14 South Street, Park Lane, London, W.1, on Saturday, September 12, at 7 for 7.30 p.m.

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Originally announced for July 24, the reunion of No. 66 (F) Sqn. has now been postponed to September 11 owing to Service commitments. The squadron is at present based at R.A.F. Acklington, Morpeth, Northumberland.

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The history of No. 205 Sqn. is being recompiled and F/L. R. James, the squadron historian, would be glad to hear from anyone willing to lend photographs or documents, or to recount personal experiences. He can be contacted at the unit's present base, R.A.F. Changi, Singapore, 17.

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Photographs, souvenirs and other items of interest connected with No. 18 (Bomber) Sqn. throughout its history are being collected by the squadron, and it would be appreciated if ex-members with such mementoes would get in touch with the Officer Commanding, No. 18 Squadron, Royal Air Force, Finningley, Doncaster, Yorks.

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No. 230 Sqn., which took over its number from the former Sunderland squadron on September 1 last year, is anxious to trace the whereabouts of silver and other property formerly held by the squadron. Any ex-members who can help are asked to contact the commanding officer, S/L. W. J. Simpson, D.F.C., No. 230 Squadron, Royal Air Force, Upavon, Pewsey, Wilts.

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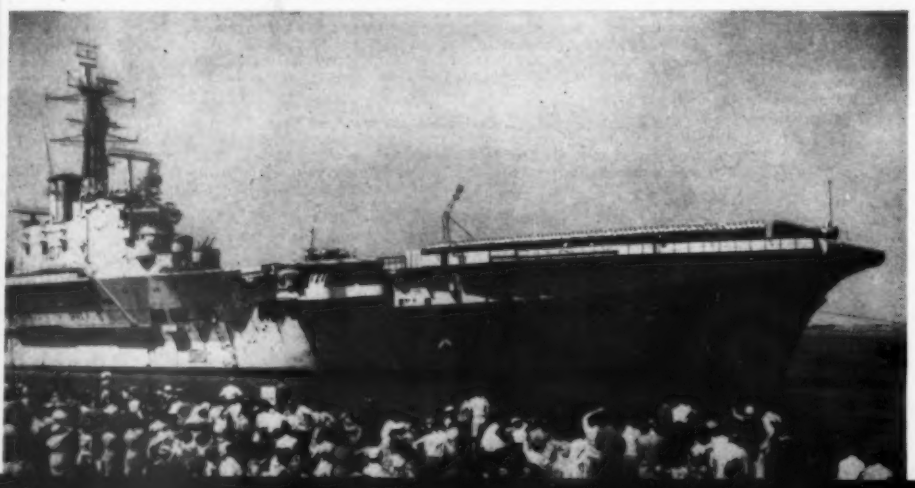
Changes in the structure of the R.A.F. Education Branch were announced by the Air Minister, Mr. George Ward, on July 1. Permanent commissions are to be available on entry to those who want them and are considered suitable; there will be a new avenue of promotion above squadron leader for those with specialist knowledge and experience, mainly in scientific or technical subjects; and retiring ages are being reduced, to make it easier for officers who leave the Service in the middle ranks to fit themselves into civilian teaching.



H.M.S. "Albion" (Capt. A. B. Cole, D.S.C., R.N.), arriving at Portsmouth on August 18, nine months after starting her duty east of Suez. Since then, the carrier has visited ports stretching 10,000 miles across the Southern Hemisphere

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